October 1983 Volume 2 $2.50

softalk

for the IBM Personal Computer

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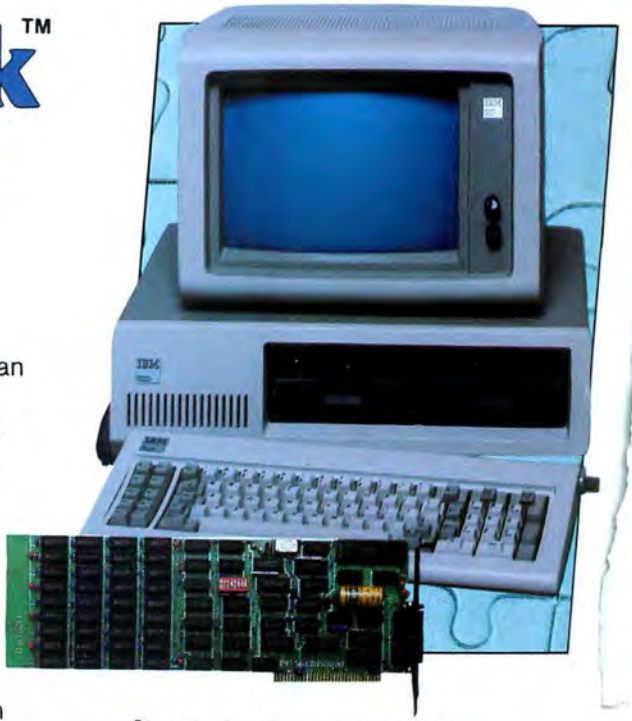

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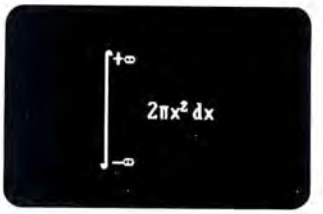

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softalk

for the IBM Personal Computer

Features

Columns

Departments

Every businessman's fall fashion lineup should include something in a modern graphics style, accompanied by the proper plotting.
Stories begin on page 96.

Cover photography by Kevin McKeon and Tim Durr, Art by Dan Winkler

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softalk

for the IBM Personal Computer

Softalk for the IBM Personal Computer

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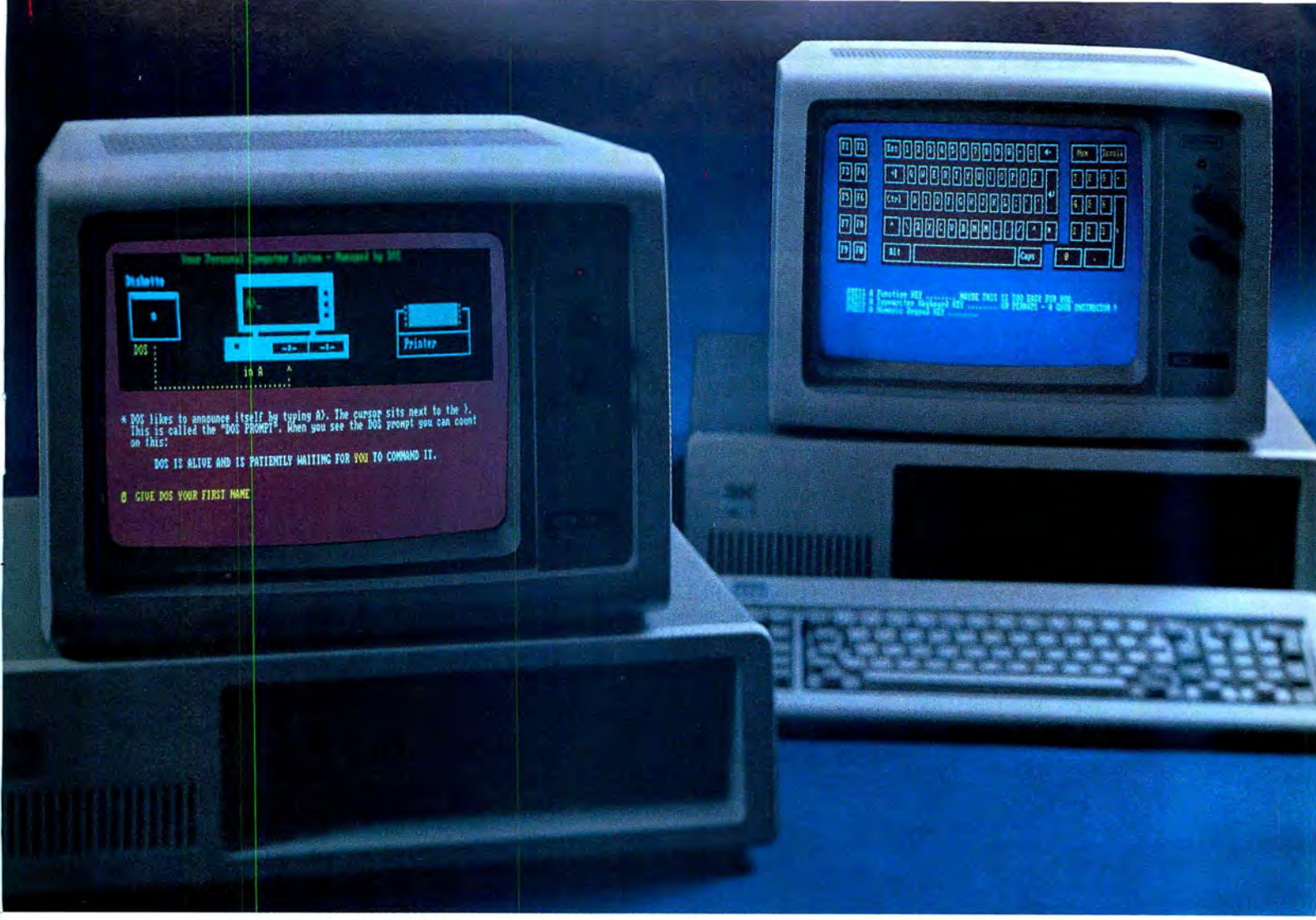

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Please write or call for additional information. Softalk/IBM Classified Advertising, 11160 McCormick, Box 60, North Hollywood, California 91603. Attention: Linda McGuire Carter (213) 980-5074.

crosstalk

Toddling—The pc Comes of Age

Late in 1982 I first discussed the idea of investing in a pc with my family. As a professional programmer, I had used a pc at work and could envision a long list of fascinating projects. My wife had never before used a computer, but has a technical education and was easily convinced. My daughter was brought into the fold when we agreed to buy a few games. Result: Like a growing number of families, we now have a pc in our den.

As soon as the pc arrived, I plunged into it with enthusiasm and have since completed several fair-sized projects. For me, at least, the pc is quickly becoming a tool rather than a toy. My wife, being the studious type, started reading a book on Basic and is now hesitantly, but steadily, developing her first system. My daughter took to the games like a fish to water.

But we also have a three-year-old. Too young for programming and too young even to play the games, he was left out. Tommy was strongly affected by our enthusiasm for the computer and, in his own way, wanted badly to be included. Unfortunately there is little software available for three-year-olds who can't read and aren't even physically coordinated enough to consistently hit the right key.

Tommy found that he could simply tap away at the keyboard and letters would appear on the screen. He did no harm (the pc's keyboard is pretty tough) and it amused him, so we let him do it now and then. Then he discovered that, if he held an individual key down long enough, the keyboard buffer would fill up and the pc's speaker would complain. He liked the noise, but it irritated me. I decided to do something for him.

The accompanying program is the result. Called, appropriately enough, Tommy.bas, it has held his attention for up to fifteen minutes at a time—a major accomplishment for most three-year-old boys. Now that Tommy has his own program, he seems to feel included when we talk about the computer and, probably more important, he is learning that the pc, and computers in general, can be part of his life.

Tommy.bas is a very simple program consisting of a single loop. Line 150 reads a single character from the keyboard. Using the ASCII code for that character, lines 160 to 170 select a frequency and beep the speaker with that frequency. Line 180 randomly chooses a color, with the uninteresting ones filtered out in line 190. (Colors won't be displayed unless you have a color/graphics adapter and color monitor.) Lines 200 and 210 display the character on the screen. The result, when Tommy types randomly at the keyboard, is a screen full of brightly colored, flashing characters, and a series of almost random tones from the speaker. The function keys, in particular, are interesting because they produce short "musical" phrases.

If you have a toddler who wants to be involved, Tommy.bas might be for you.

Jan Young, Port Washington, WI

Volunteering Some Standards

The world of micros is growing like topsy, and in the process some direction should be given to the services that are offered to readers of personal computing magazines. The reviews of software and hardware don't often get into the real meat of computing. They spend most of their time counting the drives and comparing the number of Ks in memory. That doesn't really do anything that a neophyte couldn't do for himself.

What is needed is a real comparison for important matters—things that the average person may not know how to do, or that he doesn't have the manuals to do it with. Such information as a count of error messages in DOS and Basic, or an enumeration of commands, statements, functions, and variables. When a reviewer says that there's nothing the IBM Personal Computer can do that can't be done by any other machine, I cringe for the poor soul that doesn't know how to program in machine language.

Really important facts include such things as detailing the functions that reside in the ROM and Basic interpreter that are ready to do their thing without learning source code. The way the computer interfaces with its intended I/O peripherals—is it quick and easy, or does it get hung up and report errors regularly—would be valuable to know. How big is ROM? What is in it? Is it accessible to the user? What about interfacing the computer with different monitors? Accessibility for service and service charges is an important point. Are there built-in utilities (like *Edlin*, *Debug* and its disassembler, or *Link*) that come free of charge, while other manufacturers may sell them as separate boards later?

As you can guess, these are the beginning of a set of voluntary standards for the industry, both ethical and technical.

One last comment about the myth of sales

```
10  REM ************************************************************
20  REM *                        TOMMY.BAS                           *
30  REM *          A Simple IBM-PC Basic Program for Toddlers        *
40  REM ************************************************************
50  SCREEN 0:CLS
60  X$=INKEY$:IF X$="" THEN 60
70  A=ASC(X$)*1.5
80  IF (A < 37 OR A > 32767) THEN 60
90  SOUND A,1
100  B=INT(31*RND)
110  IF B=0 OR B=8 OR B=16 OR B=24 THEN 100
120  COLOR B
130  PRINT X$;
140  GOTO 60
```

ANNOUNCING THE END OF WORD PROCESSOR CONFUSION

It's one confusing business, choosing a word processor. All those companies assuring you theirs is the most fantastic one of all. And leaving you to cut through all the smoke and hopefully whittle them down to the best one for you.

Well, we can help. If you'll just invest the next three minutes reading this, we'll tell you about a word processor that makes picking the right one a real breeze.

FIRST, A WARNING. There are two things you must do when evaluating any word processor. First, be careful. It's no secret that many of today's claims about being easy to learn and use just don't stand up to careful comparison. Watch carefully for complicated codes and programs that require "training sessions." Secondly, be selective. Buy a word processor you can use on a daily basis, not one that requires another "training session" when someone goes on vacation. In other words, be very careful to select the word processor that's absolutely the best and easiest to use. Which is what we'll now introduce you to.

WHY ONE WORD PROCESSOR MAKES THE MOST SENSE OF THEM ALL. Meet WordPlus-PC. It's the advanced, "user-oriented" software package that turns your IBM-PC computer into a word processor equipped with the sophisticated capabilities of far larger, more expensive systems.

THE REMARKABLE WORDPLUS-PC STORY. In a nutshell, it's this. WordPlus-PC was designed from the ground up to be the very latest in word processing technology. It has all the important features you could ask for. And the program is so easy to learn and use it defies comparison with other software.

HOW WE CAN BE SO SURE OF OURSELVES. We're Professional Software, a leader in word processing software with *over* 30,000 customers contentedly churning out letters and documents around the world on personal and business computer *systems. We* know precisely what a top quality word processor must do. And we've studied all the shortcomings of our competitors. That's how WordPlus-PC came to be the easiest-to-use word processor *ever.*

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WordPlus-PC is both powerful and versatile. Its long list of major functions includes movement of paragraphs, global search-and-replace, and creation of multiple "boilerplate" and personal letters with the touch of a few buttons. There are 3-line headers and footers and automatic page numbering. When you underline or boldface words as you type, WordPlus-PC displays them in that form on the screen. You can merge information created by popular spread sheet programs. You'll create personal letters quickly and easily, or merge name and address information from other programs. You can easily create standard layouts for preprinted forms and use WordPlus-PC to prepare invoices or quotations. For large corporate customers, WordPlus-PC has the capability to merge information from files created by the firm's mini or mainframe computer. You can even type new documents while the system is printing other ones. And you'll find WordPlus fully compatible with virtually all popular ASCII letter-quality and dot matrix printers.

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With WordPlus-PC's easy-to-use documentation, you'll be using your word processor right from the first minute. After an hour, you'll feel at home with all the basic functions and ready to explore the more sophisticated ones. After a few hours you'll put the manual away. There are never any complicated or confusing codes to memorize or look up. Rather, the screen's "message area" reminds you how to do what you want. WordPlus-PC's unique keyboard color coding makes things even easier. And whenever there's a question, simply press the HELP function to get back on track.

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and service from the dealer: It's great until they help you to your car with a load of boxes that you just paid for. After that, it's generally what you can force out of them with a thumb screw. That's why mail order has such a high percentage of adherents, and needs some ethics and standards, too.

Louis A. Warner, Woodbridge, CT

Not Wild about WordStar

In a letter on page 15 of your June 1983 issue from Leonard Fischer of Los Angeles, there is mention of a product from TRAX called *TieLine* to transfer files between the Apple II and the IBM pc without RS-232 ports or serial hardware. I'd surely like to know more about this, but have not seen it advertised. Could you send me an address or telephone number?

I would like to commend you on the job you're doing with *Softalk*. I've gotten more useful information from your magazine than all the others combined.

You have also answered my problem with my printer: My Printmaster was dropping a character or two every page and a half. I pulled the 2K buffer, which solved the problem, but thought the cause was in the printer. Learning about the printer timeout problem in PC-DOS was a real revelation. Now, I can go back to simultaneous printing and editing with *The FinalWord*.

And in July, I found out why the system would hang when *ProKey* cleared at the end of an Autoexec.bat when you printed K.D. Bremer's letter about its incompatibility with Scrollk.com.

One comment I can't resist. I use my pc for word processing. After telephoning every software house that offered word processing for the pc and presenting a detailed list of questions to each, I thought I had a pretty good understanding of the market. I began my search enthusiastic about *WordStar*, but quickly discovered that it wasn't what it was cracked up to be. My concerns were lack of customer support (MicroPro was the only software house that refused to talk to me during my telephone survey) and lack of support for crash recovery and true proportional spacing.

I am amazed that *WordStar* continues to be popular, despite tremendous deficiencies (terrible customer support, poor printer support, unnecessary complexity, slow response, and more). There are several programs on the market that are better for any application and it is obvious that customers and retailers alike are just not taking the time necessary to make a wise choice in software. (Yes, I know *WordStar* 3.0 is better. That still doesn't mean it's good.)

The only way to buy a system is to start with a clear knowledge of one's own requirements, then shop for well-supported software that does everything needed and appears not to be too difficult to learn. (Yes, Jim, this means buying a demo disk or manual or both! It may even mean fifty bucks in long distance phone calls to software houses. But it's worth the investment because it will save time and grief later.)

After choosing software, then is the time to buy a computer that it will run on. I admit there's some leeway here—I was leaning toward the IBM monochrome display for word processing but first made sure I could get the software I wanted.

For example, the only program that had the features I needed was *The FinalWord*.

I wanted support for a daisy-wheel printer with true proportional spacing, not just microspace justification. *TFW* has this, and in addition, turned out to have translation tables that have allowed me to use Qume's nice WPS sequence print wheels in my C. Itoh Printmaster. Almost any part of the printer driver can be changed through their configuration menu.

I wanted excellent crash recovery, because the electric power in my part of the north woods is not reliable, and *TFW* has a virtual-memory scheme, that, without interrupting me, puts my latest text on disk every time I stop to think.

I wanted split-screen editing of multiple files, fast response, and automatic footnotes, tables of contents, and index generation. All of these were in *TFW*, and more.

I relate these things not so much to praise *TFW* as to point out that there are usually hidden characteristics of any program that can make it either a special pleasure or a spe-

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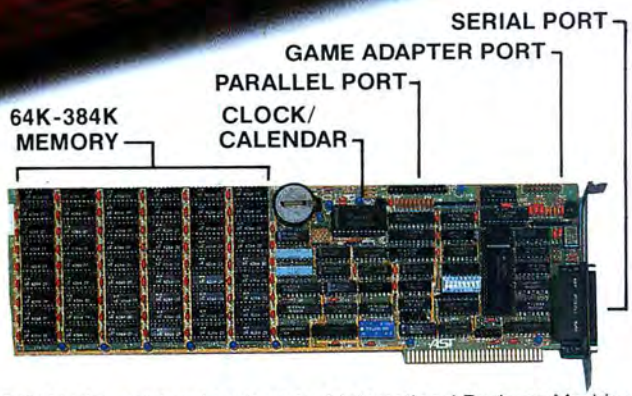

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The IBM Personal Computer

which is which.

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cial pain. It is very important for users to know what they are buying, even if that knowledge comes at a price. Then the user won't discover that his $550 *WordMan* processor will only drive his PinPrinter in reverse, and even at that, with a pause after each word.

Please keep up your useful service to readers. May a pox come upon you so that you don't grow to 600 pages of advertising and insipid flatulence.

Daniel L. Johnson, Rhinlander, WI

Information on the "Direct Connect" IBM-Apple link is available from TRAX, 8948 West Twenty-fourth Street, Los Angeles, CA 90045.

Dial P for Parity

Readers interested in Freeware's *PC-Talk III* should be aware of one apparently minor but easily solved problem in what is otherwise a superb program ("Marketalk Reviews," August 1983).

In version 830424 of the 128K compiled program a configuration of 300 bps, seven data bits, one stop bit, and no parity will inhibit the auto-dial function. Although the "DIALING" prompt appears, no dialing takes place.

Changing all parameters except baud and parity made no difference; changing only parity (to odd) solved the problem. If users must use seven data bits with no parity the keyboard dialing option will work.

According to the on-disk documentation, the program will support no parity if an eight-data-bits configuration is used to transmit a binary file.

I have not used the 64K interpreted version of the program that comes on the same disk.

The presence of this apparent minor bug does not diminish in any way what is an excellent program that provides users maximum utility, flexibility, configuration options, and documentation—all of which should be emulated by the rest of the industry.

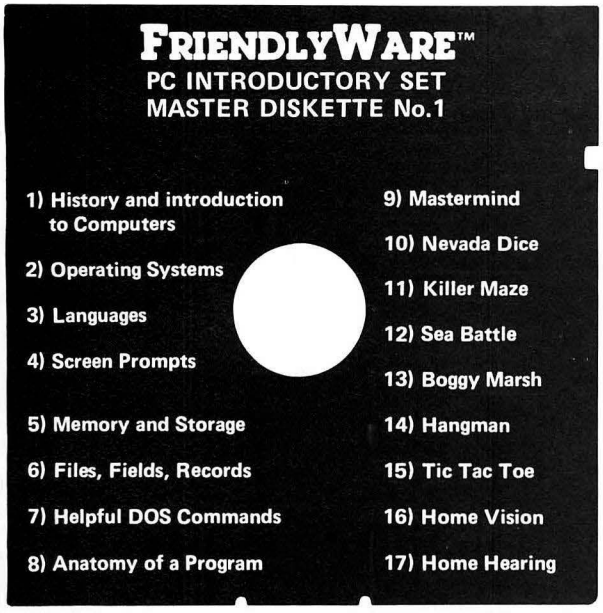
Andrew Fluegelman should be commended both for this program and the Freeware concept.

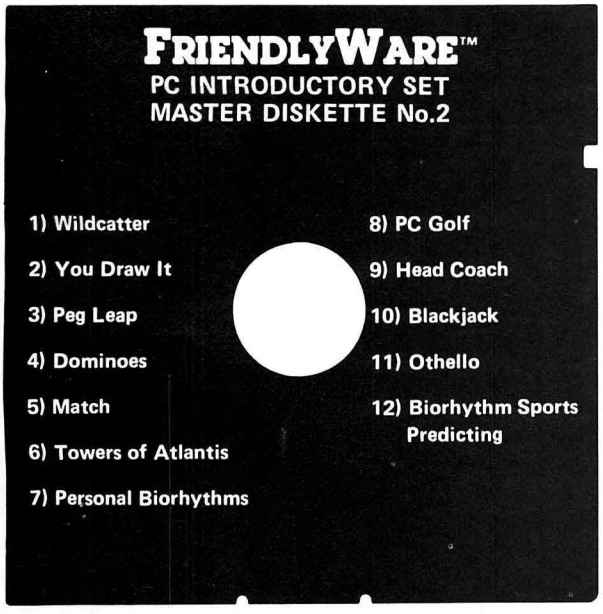
Chris Bagdikian, Bakersfield, CA

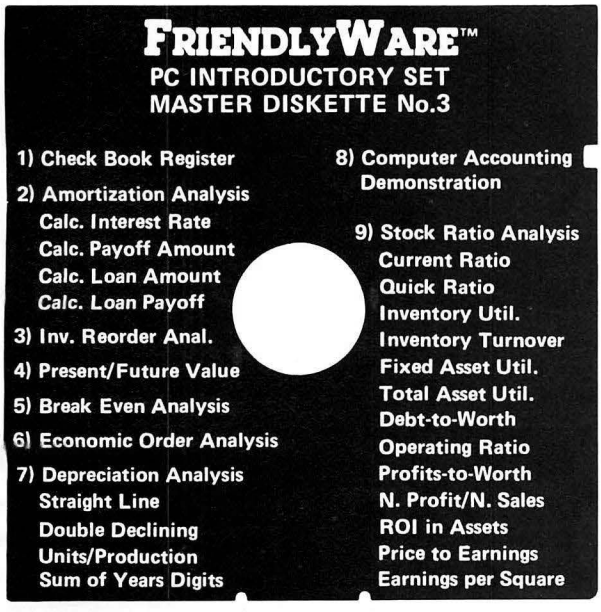
Peaches Patches

You might tell your readers that IBM has released a diskette of patches to the Peachtree Accounts Receiveable package it markets. The patches clear up several problems with Version 1.0 of the program. The updated programs are called V. 1.02 by IBM.

Owners of this software can take their program disks to an IBM dealer who will update them free of charge on the spot. (IBM has supplied the patches on a disk with an Autoexec.bat file that makes updating the three programs fast, easy and idiot proof.)







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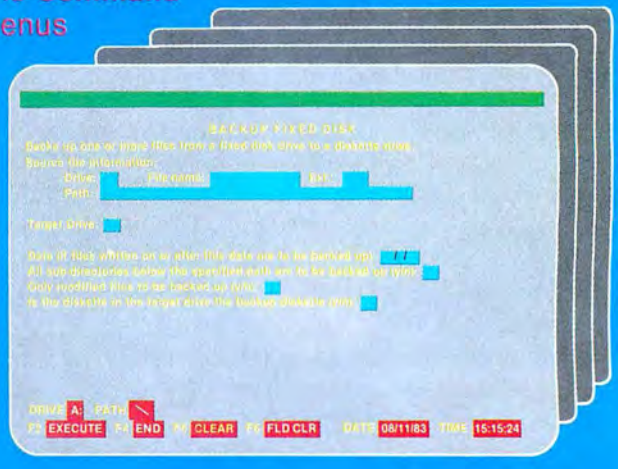

The menu describes the function of the command and presents all the available options.

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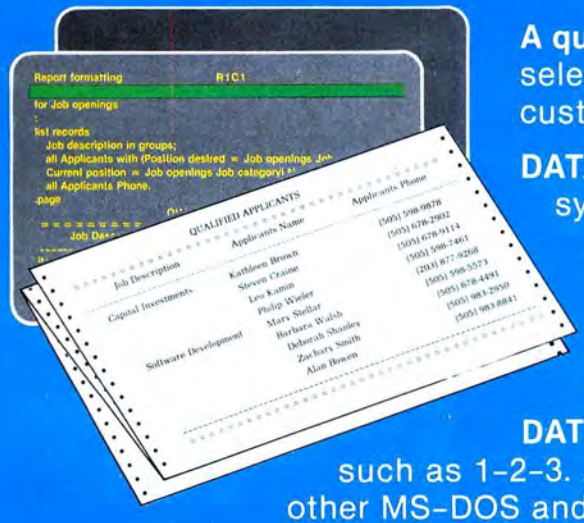

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The patches were released last January, but most owners of this software probably don't know it, as IBM did not notify owners of V.1.00, even those like myself who purchased it from IBM Product Centers. (The package costs $595. For that kind of money, most people would probably expect better support. Andrew Fluegelman's Freeware *PC-Talk* is better supported . . . .)

Also, don't be surprised if a dealer is unaware of the patches. (It took about five minutes to convince the representative at Orlando's IBM Product Center of the existence of the patches.)

Finally, IBM will upgrade its Peachtree accounting software so that it will run under DOS 2.0 and and the XT's hard disk. The upgrade costs $120 (yep, $120) for the A/R package alone.

Accounting programs are pretty boring, but they turn a pc into a useful business tool.

Michael Truffer, Deltona, FL ▲

WINNERS

Is the contest column cursed or what?

Bad news this month for all of you who entered the design-a-software-package contest: Your entries have disappeared! During a relocation of the contest editor's desk, the folder with all of the entries in it was either thrown away or misplaced. If they show up, we'll let you know. We apologize to all who went to the trouble of entering.

Meanwhile, we have a winner to announce in the contest, even though there isn't any art to show. We don't remember the name of the artist, so, whoever did the sketch for BS.DOS, the ultimate hard disk in the shape of a frozen pizza, please send us a copy of the entry along with your address, phone, and name of the nearest dealer. Your hundred clams are waiting.

Attention Bruce Nissim and Alan Weiner (*Snobs* contest winners), Judy Hendrickson and Laura Watson (*Limericks* winners), and Becky McMennamin (*June Jumble* winner): Please send us your addresses, phone numbers, and the names of your nearest dealers. You all have prize money coming and we haven't received any response to letters sent informing you of such.

Next month, for those of you who managed to get around the obstacle of a solid black entry coupon, the winner of the best one-liner contest will be announced—if we ever get through the flood of entries. It is our most popular contest to date.

We have saved the best for last. It's so unbelievable, so bizarre, so shocking that we almost don't dare reveal it.

First, we'd like to announce that the best of the five limericks printed in our June issue, by your vote, is the ditty about Sybil the rat. One hundred dollars goes to Thomas Fay (Bloomington, MN).

Second, as we announced in this column in the August issue, fifty dollars goes to a random card picked from the limerick vote cards. Surprise! The winner is none other than our publisher, Al Tommervik, who takes all corners of his domain quite seriously and entered his vote on a card just as the rest of you did.

Well, we don't want to give Al fifty dollars—it would look a little cheap, wouldn't it?—so we dipped into the vote cards again.

Here's the punch line: The next card picked was sent in by none other than Thomas Fay (Bloomington, MN)! Well, fate is twisting too hot and heavy in this department, so here's another fifty dollars, Thomas. Sybil has made you a rich man three times over, counting the first twenty bucks for being a runner-up.

Thank your lucky rat! ▲

QUESTIONS & ANSWERS

by Nancy Andrews

Q: I recently purchased an assembly language subroutine for sorting. The subroutine is called from Basic by the lines:

```
40 DEF SEG = 0
50 MEMORY = PEEK(&H413) + PEEK(&H414)*256
60 DEF SEG = MEMORY * 64-32
70 BLOAD "SORT",0
```

My pc is a 64K unit with a 256K AST Mega-Plus card. Peeking at addresses 413H and 414H gives values of 64 in 413H and 1 in 414H. I assume address 413 gives the amount of memory on the system board and 414 gives the amount of add-on memory in units of 256K.

Is the above assumption correct?

If I configure the extra memory as an electronic drive and print spooler, does *Sort* get loaded into areas reserved for the electronic disk and print spooler? Is there any chance that it might get written over?

Where could I have found answers to the above questions? The *Technical Reference* manual refers to address 413H but not to 414H.

Santi Vibul

A: Your assumption is not exactly correct. When the *Technical Reference* manual refers to address 413H, it uses the instruction DW, which defines a word two bytes long and includes both 413H and 414H. The word stored beginning at location 413H contains the amount of system memory; 413H contains the low byte and 414H the high byte. You need to concatenate these to get your total—64 in the low byte and 1—really 2 to the 8th or 256—in the high byte, making your system a total of 320K.

Your sort program should not get written over, since either the programs that manage the print spooler and electronic disk or DOS itself should change the value in locations 413H and 414H when the disk and spooler programs are loaded, making the system think it has less memory. You might check these locations when running the electronic drive and spooler to be sure this is true and that your sort program won't be overwritten.

You looked in the right place in the *Technical Reference* manual. You just missed the DW instruction.

Q: The Basic *shell* command was mentioned in your latest Q&A column (*Softalk*, August 1983). I took special note of the command because I have always needed a way to execute DOS commands from Basic.

How did you learn about this apparently undocumented Basic command? It is not listed in the Basic and DOS manuals. I am also wondering how to execute the *shell* command within a program without losing control. Results were unpredictable (catastrophic?) when I tried executing the command in a short test program. In most cases the system would hang up immediately after executing the command. The condition usually required an off/on restart; a warm boot was impossible.

For example, after executing the statement *10 shell "dir"*, a directory of the logged drive would indeed be displayed on the monitor, but the next line:

20 PRINT "The files on the default drive are listed above."

would not be executed. The system crashed before executing the *print* statement. Similar unpredictable results occurred when other DOS commands were substituted in line 10. I'm wondering if you have an explanation for the system's behavior?

Can you shed any light on the uses of the "advanced" DOS *ctty* command? The command supposedly defines the I/O device to be used as the primary console (Com1, for example). Is it possible, by using this command, to have a remote device act as the main console? It would be helpful if the system unit could be accessed interactively over telephone lines. (The nearby IBM Product Center was unable to explain the *ctty* command sufficiently.)

Finally, I've found an alternative to John Foster's question (*Softalk*, August 1983) about running a batch file from a menu program. What you can do is write a batch file and then write a menu program that alters the second line of the batch file. Here's how it works:

The first line of the batch file is a call to the Basic menu program that presents choices and waits for a response. For example,

```
BASICA MENU
```

Then the menu program takes the user's choice and rewrites it as the second line of the batch file. Next, the menu exits to DOS where the user's program is executed because it is the next thing in the batch file. The user's program must end with a return to DOS, where the batch file takes control and calls itself. This restarts the entire process by loading Basic and the menu program once again. It is most efficient when processed on a RAM disk.

For a copy of a program that does this and for more information, download "Pcmenu.txt" from the Compuserve IBM PC SIG (Access XA 4) or write to W.B. Malthouse, 5918 Veranda Drive, Springfield, VA 22152.

John Mastronardo

A: We heard about the *shell* command from someone working on Microsoft's Gee-Whiz Basic (that's the generic Advanced Basic from Microsoft). GW-Basic has a *shell* command that works well, and our source thought IBM had a similar command. So we tried it with a two-line program similar to the one you wrote. It worked and

seemed like a perfect solution to the question, so we wrote it up.

Now it appears there are some problems with the command, and this may be the reason IBM chose not to document it. We could execute your two-line program without apparent difficulty, but later if we tried to execute more Basic statements without first returning to DOS normally and reloading Basic, our system would crash, too. What seems to be happening when the *shell* command is executed is that Basic does an irregular exit to DOS to carry out the DOS command. During this exit, apparently the system state is not saved completely, and that causes problems when control returns to Basic.

We really don't have a solution for this. Perhaps in their next release of Basic,IBM will fix and document the *shell* command.

Ctty can be used with a remote device acting as the main console. But, before you issue the *Ctty Com1* or *Com2* command, you need to activate the RTS and DTR signals. You can do this by wiring the RTS line to the DTR line, or you can use a Basic statement such as:

```
OPEN "COM1: 9600,E,7,1"as #1
```

This statement activates the Com port and lets you read or write data to it, but when you exit from Basic the Com files and communication ports are closed and deactivated. It's possible to fix this problem by means of a Basic program; see the September 1983 issue of *PC World*.

You can use the *ctty* command to access a device either with a direct connection or with a modem. To control your system remotely using a modem, you'll need a modem with auto-answer capability. Here's what you need to do:

First put your modem in the auto-answer state. When the AA indicator lights up, type *ctty Com1* (or *ctty Com2*). Dial from a remote modem. When you see the DOS prompt, you're ready to go.

There are some problems with *ctty*. For example, it appears that the DOS *copy* command does not transmit carriage returns properly, and running interactive Basic programs can be troublesome. You'll have to experiment to see if you can get the functions you need.

Q: Recently I acquired a copy of *Math Tutor*, a public domain package that had been mentioned in *Softalk*. It was definitely a bargain for the $8 I spent.

I would like to locate more public domain software—for business as well as educational purposes. Is there a clearing-house or comprehensive list of such software? If not, could you suggest where I might begin to search for public domain software?

Sylvia Pulliam

A: We don't know of a clearing-house or comprehensive list of public domain software for the IBM (Apple has the Apple Avocation Alliance), but we can recommend some places for you to begin looking.

Most user groups make a library of public domain software available to their members. The May 1983 issue of *Softalk* has a list of user groups; you could contact the librarians of the groups near you.

The Headlands Press (Box 862, Tiburon, CA 94920) pioneered the Freeware concept, and you can write to request a catalog. Two other places to check are the electronic bulletin boards (they often provide software donated by users) and, of course, the magazines.

Q: I am trying to write an assembly language program to read a nonstandard IBM cassette tape. Most of the BIOS listings on this subject seem pretty clear, but I am still confused about how timing is figured and how the various ports that are used are manipulated. I have been unable to find anything written on this subject.

John Parks

A: Unfortunately we can't be of much help. All the IBM cassette port does is convert the audio signals into a high or low bit; all the rest is done by software timing loops. The only way you can write correct loops is to find out how the tapes were written. There just doesn't seem to be any other kind of help available. Sorry.

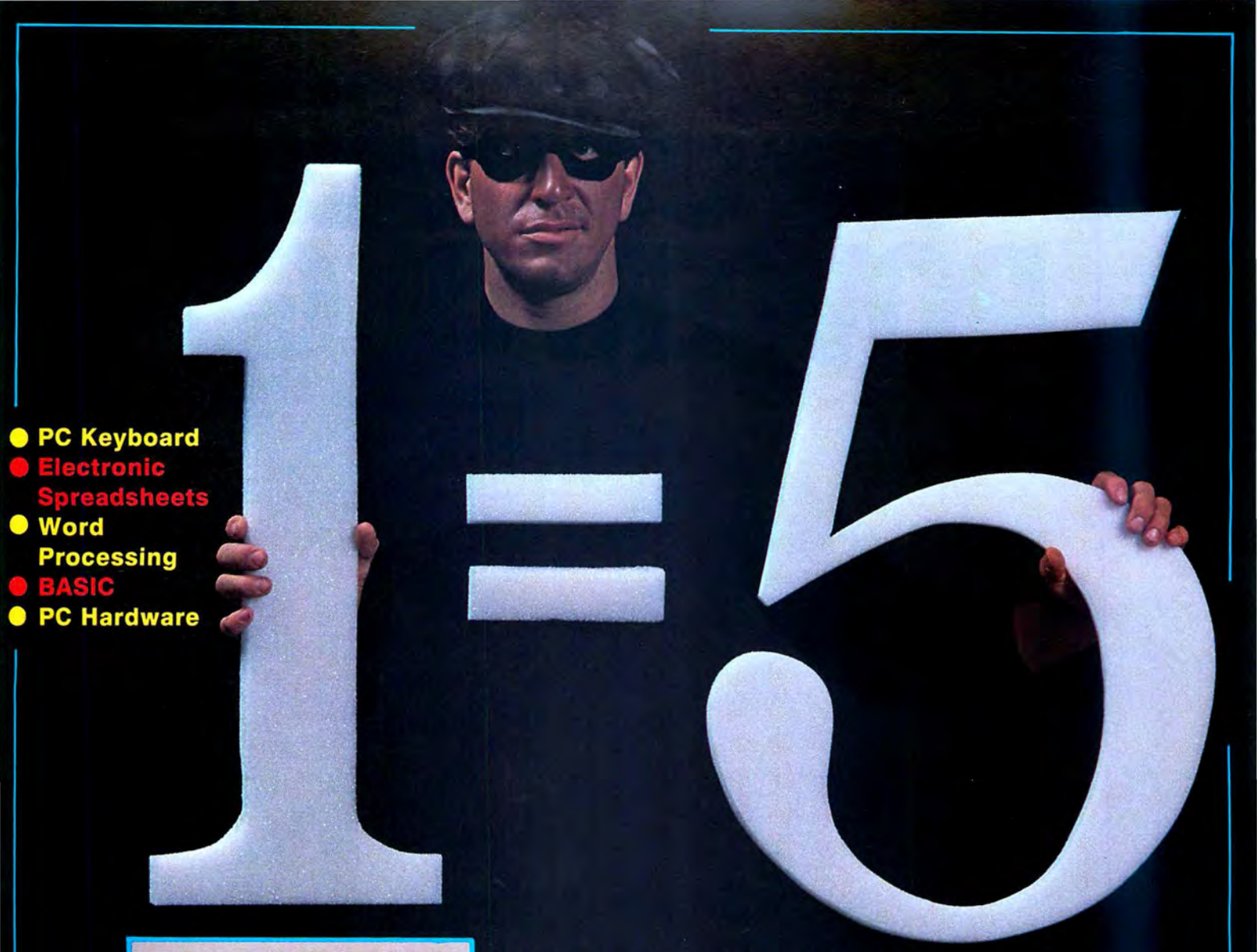
Q: I'm a new subscriber and really enjoy your column. Your suggestion of using *shell "graphics"* (August 1983) for printing the screen will not work because *graphics* simply loads the code to handle graphic printing; it does not issue it. When I tried this command, an error message was issued and I was returned to DOS. Here is a routine that will print the screen from a Basic program.

```
10 R$ = STRING$(5," ")
20 R% = VARPTR(R$)
30 RTN = 256*PEEK(R%+2)+PEEK(R%=1)
40 FOR I% = 0 TO 4
50 READ C%
60 POKE RTN+I%,C%
70 NEXT
90 CALL RTN(V%)
100 SYSTEM
110 DATA &HCD,&H05 ' int 5h
120 DATA &HCA,&H02,&H00 ' ret 22
```

I would very much appreciate it if you could advise me where to find more documentation for the *shell* command.

Shawn Patrick

A: If you could find a manual for GW-Basic, recently renamed Graphics Basic, you could find documentation for this command and what it should do. GW is the Basic used on the NEC, Zenith, and many other computers. However, as explained earlier, the *shell* command does not work properly on the IBM. ▲



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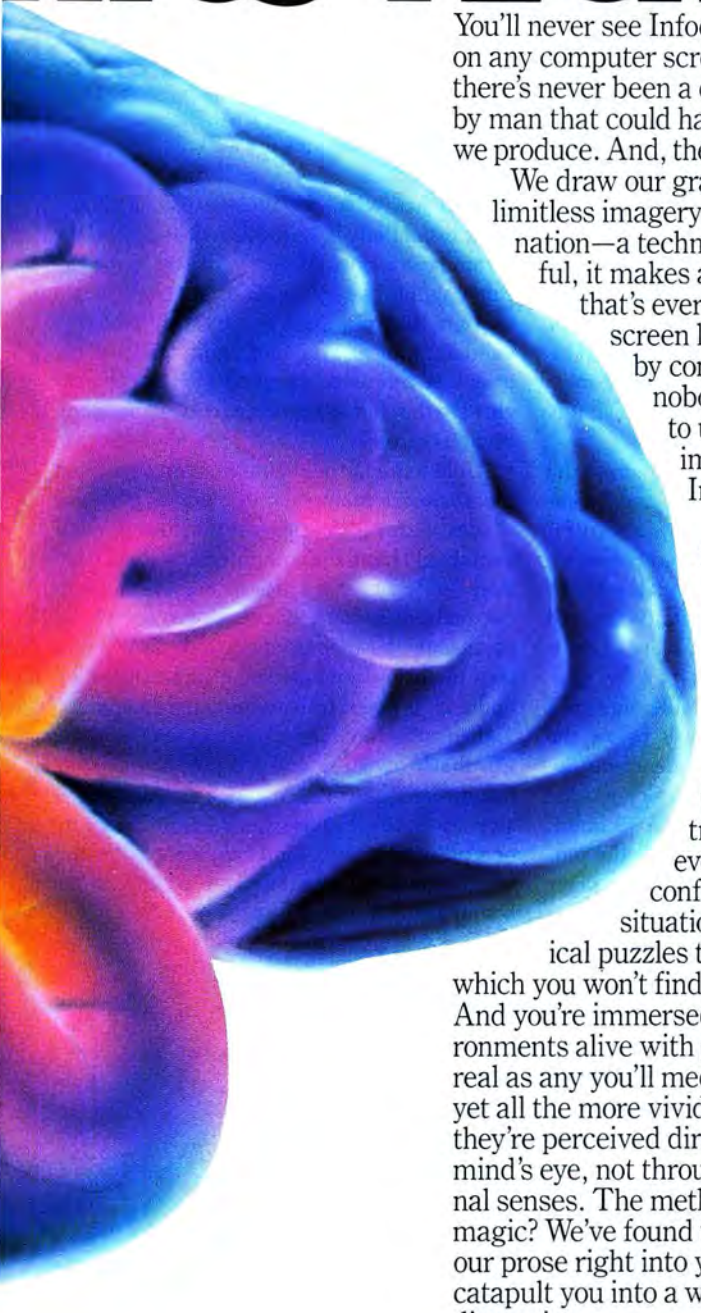

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COMM LINES

by Kevin Goldstein

Strategist Modems and the UART of Chatter

As we discovered last month, there are numerous advantages to putting a carrier on the line continuously, rather than keying it on only when there is data to send. Quicker, easier, and more accurate detection of data bits is one advantage, and the ability to recognize immediately when a phone line connection has been broken is another.

But the decision to use a constant carrier modulation scheme, you might recall, left us with a problem. Using a modulation scheme that keys the carrier on only when there is data to transmit makes it a cakewalk to determine the beginning of a character: The start of tone is the beginning of the character. If the carrier is always on, though, how can the computer listening to the modem tell whether that constant tone coming over the line is simply a constant tone coming over the line (you might remember that the constant tone is called a *mark hold*) or valid data consisting of a string of 1s?

If you think about it, you might notice that the problem would simply never occur if all valid characters started with a space (0) bit. If that were the case, the phone line, when idle, would be marking time with mark hold; since in our hypothetical scheme all characters begin with a space bit, the transition to a space bit would then mean that transmission of a new character had begun.

But, you protest, not all character transmission will begin with a space bit. As a matter of fact, transmission would start with a space, or 0 bit, only for about every other character, since the least significant bit is transmitted first.

The solution, my dear Watson, is elementary: just have the transmitting (originating) computer slap a space bit onto the front of each character. Then the listener can always tell when a new character first appears on an idle line. Let's call the space bit appended at the start of each character the *start bit*.

Once you've got that idea down pat, understanding how a computer finds a character boundary—that point in the signal where one character stops and the next one begins—is fairly straightforward. Before we get to that, though, this might be a good time to take a look at just who's doing what and what's doing whom in this whole modulation (encoding) scheme.

We've been talking about modems and about how a modem encodes digital data from a computer in such a way that the data can be coupled to an analog phone line. What may not be clear from the discussion is this: That is *all* a modem does!

To a modem, everything coming across the phone line is just one long string of undifferentiated bits—a modem doesn't know a start bit from a shoebox. All a modem does (when receiving, for example) is hold its analog ear to the phone line and, with its digital voice, tell the computer just what it hears: Now I hear a 0, now it's changed to a 1, now it's a 0.

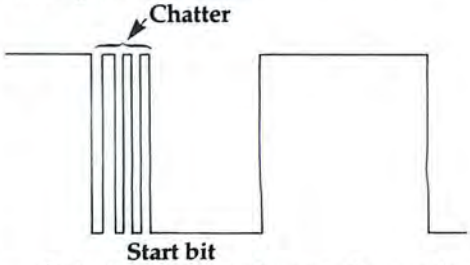
Even the bit rate makes no difference to a modem; as long as the bit rate is below the maximum rate at which the modem was designed to run, the dumb little device works. You can use a 300 baud modem at 10 baud, 59.87 baud, 199 baud, or 300 baud; the modem doesn't know, it doesn't care; you don't need to tell it the baud rate, and it makes absolutely no difference as far as the operation of the modem itself goes. Just keep your transmissions below the maximum bit rate, and everything's fine.

By now we hear a howl of protest. "My smart modem needs to know the baud rate," you declare.

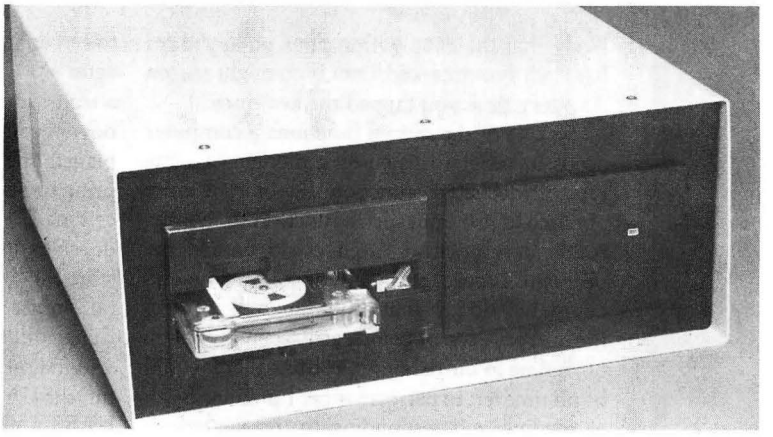
And so it does. But only because it's smart and therefore capable of doing things that strictly speaking are not modem functions. As a matter of fact, many of the functions that make a smart modem smart are duplicated in the computer—not because hardware manufacturers are looking for ways to charge us more money, but because historically those functions were not included in the modem; thus to leave them out of the computer would be to risk grave incompatibilities. The word "modem" in the microcomputer world has come to mean a device that not only acts as a modem, but also as an autodialer and occasional coffeemaker; it's the autodialer etcetera that needs those extra extra functions.

And just what are those extra functions? Well, recall that all the modem does is hand the computer a string of 0s or 1s. It's up to the circuitry within the computer to put some meaning onto that mishmash of bits: Are all those 1s valid data, or just the mark hold tone? Where does one character stop and the next one begin? Do the characters being received have any obvious errors?

Unlike life in the digital domain, signals in the analog domain exist in black, white, and shades of gray. While it's true that ideally a modem would hand the computer a clear-cut decision—now I hear a 1, for example—things in the real world aren't quite as convenient. In particular, the modem might not cleanly discern the transition between a 1 and a 0 (or a 0 and a 1); it might instead hand the computer a 1, then an instant later change its mind and say no, that was really still a 0, and yet another instant later say, aha, it *was* a 1. This indecisiveness is called *chatter*, and a timing diagram of a bit with some leading-edge chatter (meaning chatter at the beginning, or left end, of the bit) might look like this:



Such sloppiness on the part of an analog modem is simply a fact of life in the analog world. And modems aren't the only place the phenomenon appears. The same thing occurs with switches—except for a few expensive and exceedingly well-designed ones. In switches the phenomenon is known as switch bounce (first on, then off, then on, then off), and if the switch is to be connected directly to a computer it's generally cheaper and more effective to program the computer in such a way that it can recognize and then ignore such bounce. It's



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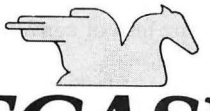

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likely that the 8048 within your pc keyboard has such a routine; did it not, you might see ten *A*s every time you tapped the key once.

So one of the special functions a computer needs in order to listen to a modem is some type of "dechatter" function. It would be quite possible to program such a function so that the 8088 microprocessor itself could handle the problem. Indeed, some interfaces for low-end computers do just that. But at high data rates, the microprocessor could easily spend so much of its time in the debounce routine there would be no time left to perform other functions, such as reading and responding to the keyboard. Having a powerful microprocessor perform such low-level and time-consuming routines is not a good use of resources.

In the pc, the dechatter task—along with several others that we'll look at shortly—is offloaded onto special circuitry on an optional board called an asynchronous communications adapter. A specialized chip on that board—called a *UART*, for Universal Asynchronous Receiver/Transmitter—is the device that's directly connected to and listens to the modem.

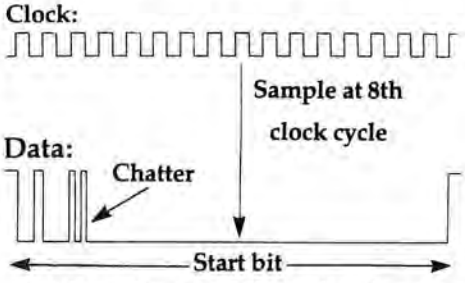
The UART performs several useful functions like the one just described. It's the job of the UART, for example, constantly to monitor an idle line for the start bit (transition to a space), then to grab the next seven (or eight, or nine—UARTs are generally programmable) bits as they come in from the phone line, until all the bits that make up a character, plus any check bits, have been received. At that point, the UART may verify that the check bit (which is called parity and will be discussed later) is correct and that there are no obvious errors, then interrupt the microprocessor and hand it a complete character.

This very brief description should make obvious one of the most important jobs of a UART. A microprocessor can deal with many bits at once; that is to say, a microprocessor can handle multiple bits in parallel. (Internally, the 8088 microprocessor in your pc handles sixteen bits at a time; when it communicates with memory or other devices, however, those sixteen bits are broken up into two groups of eight bits each.) So rather than handing it one bit at a time, which is the way it has received the data from the modem, the UART first collects all seven (or eight, or whatever) bits and assembles them into a character, and then it hands the character over to the microprocessor. Thus one of the primary goals of the UART is relieving the microprocessor of the time-consuming task of converting data from serial to parallel.

Now let's look a little more closely at just how a UART goes about performing all its tasks.

The first problem a UART faces, as we just discovered, is to determine the transition between an idle line and the beginning of a character. We already know what it has to look for: a transition from mark hold to a space bit. (It now becomes reasonably clear where the start bit gets added: The transmitting UART sends it prior to sending the character.) When the receiving UART sees that transition, however, it doesn't automatically assume it's seeing a valid start bit; it might just be perceiving momentary noise on the line. So the UART checks things out first. Here's how.

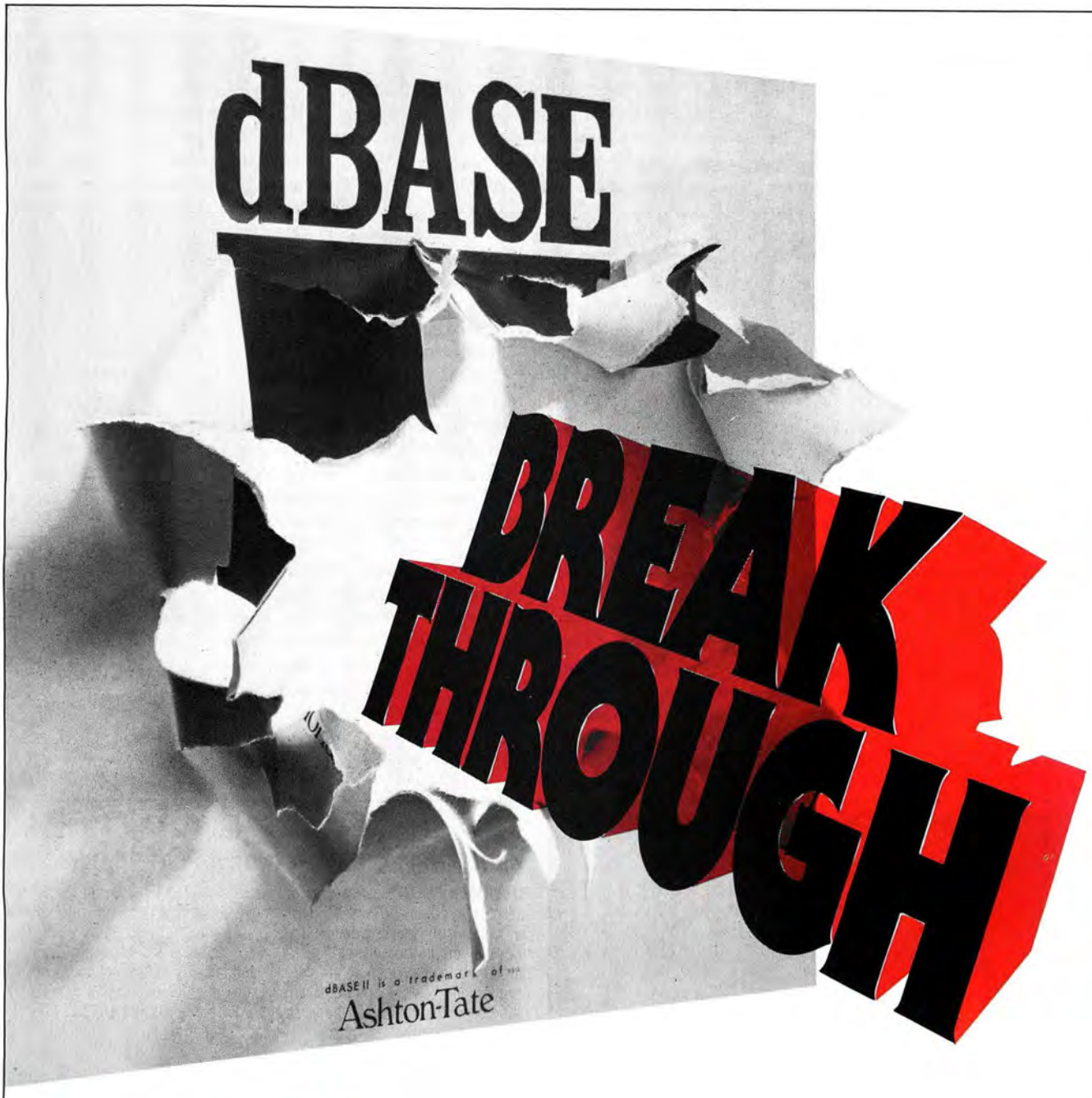
First, at the beginning of the "alleged" start bit, the UART starts a clock. You can think of a UART's clock as being just like your own clock: At regular intervals it goes "tick." Now, suppose the UART is set to receive data at 300 baud. (UARTs need to know the data rate to do their job, although there are methods by which they can figure it out without being told. In any case, though, they need the information.) Let's give our UART a clock exactly sixteen times faster than the bit rate—which in this case makes it 4,800 cycles per second (call it ticks per second, if you will, or hertz). A space bit is of exactly the same length as a data bit, so if we count eight of our clock cycles from the beginning of the start bit, we should find ourselves more or less in the middle of the start bit. Here's what it looks like:



If this really is a valid start bit, then when the UART takes another peek at the bit the modem is handing it, that bit will still be a space (0). If instead the UART sees a mark, it assumes this was not a valid start bit, and it goes back to sampling the line, looking for a start bit.

Let's say, though, that it was a valid start bit. The UART has timed its last look at the data to coincide with the midpoint of the start bit. If it now waits a full data bit time—sixteen clock ticks—and looks at the data again, it will sample the data in the middle of the bit time of the next bit (the first data bit). Now that's convenient: By the time the middle of the bit rolls around, the modem shouldn't be chattering back and forth as it does at the beginning or leading edge of the bit; by waiting till the middle of the bit time before reading the bit, the UART takes care of the problem of leading-edge chatter.

At this point, the UART need only continue this pattern to the end of the character: Wait a bit time, sample the line, wait a bit time, and so on until seven data bits (assuming standard



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ASCII code) have been received. Then it looks for the stop bit.

The what? Who said anything about a stop bit? What is it and why is it necessary?

Please, please. One question at a time. The *stop bit* is yet another bit added to the character by the sending UART. Whereas the start bit is always a space, the stop bit is always a mark. Using both a start bit and a stop bit, the receiving UART (and all this fancy stuff is done to expedite receiving the data, which is far harder than sending it) knows any character is surrounded by a 0 and a 1. You could say a character is framed by the start bit and stop bit. So say it, because that's just what those two bits are called: framing bits.

Now that we've taken care of that, let's get to the next question: Why is it necessary?

The answer is, in an ideal world it isn't. But God knows that this world isn't ideal, and while electronic components behave better than most of us, they're still not perfect. A problem occurs when the transmitter's clock is just slightly off from the receiver's. Let's say the receiver is just a little slow. If the transmitter now starts sending a continuous stream of data, the receiver will sample the incoming bits a little later during each bit time, until eventually it slips an entire bit. Not a good situation.

Now look at the same situation but with the stop bit added. The receiving UART knows that after receiving a start bit and seven data bits, it should see a stop bit. So it looks to make sure it does. Assuming it does, it then turns off its clock. If no more data is being sent, the stop bit, which is a mark, "changes" to the mark hold condition—a big nothing happens. But if data is still coming down the pike, the receiver can again use the transition to a space bit to turn on its clock—and voila: The receiver's bit clock has been been reset to coincide with the transmitter's. When start bits and stop bits are used, the two clocks can be fairly mismatched and the data will still be received correctly.

Adding the stop bit also offers the possibility of yet another bit of error detection: If the stop bit doesn't appear where it should (that is, if the UART sees a space when it expects a mark), the UART can signal the processor that it has detected a framing error. That in turn can signal the computer to perform some type of error routine, such as requesting retransmission of the data.

At this point, most of the work has been done. The UART has successfully determined the beginning of a character, waited for all the bits of the character to be received, and checked that the character is (probably) correct. Nine bits (start bit, seven data bits, and stop bit) have been received one at a time, or serially; having tossed the start and stop bit into the bit bucket, the UART now hands over to the computer all seven bits at once, thus completing its task of serial to parallel conversion.

Notice we've assumed that the transmitting UART can start sending a character whenever it pleases, and that no matter when it sends it—immediately after the previous character, 1.1 bit times later, or twenty-five minutes later—the character will be received correctly. Because in the kind of scheme we've described here the UART can start transmitting a character whenever it wishes, the transmission scheme is called "character asynchronous." (It's not "bit asynchronous" because once transmission of the first bit of the character has begun, successive bits must be sent at intervals of exactly one bit time.)

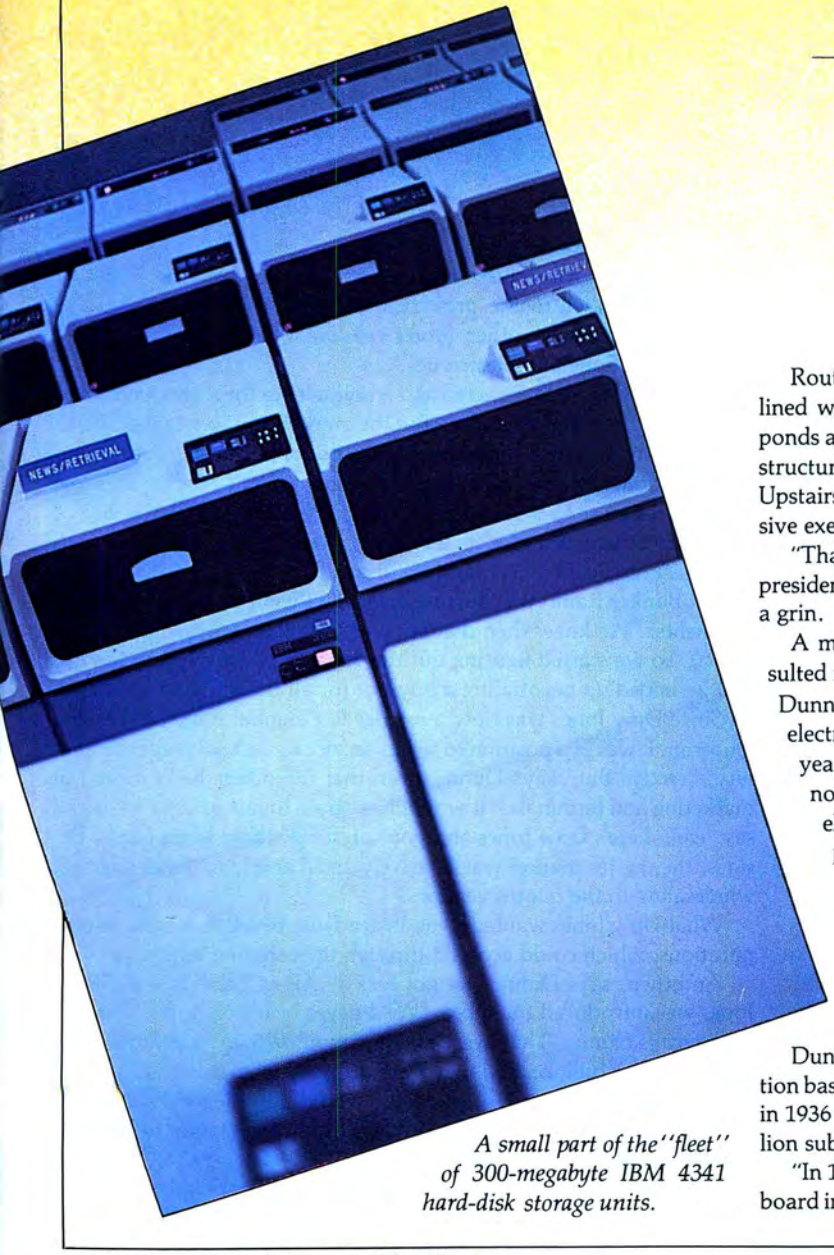
Now you know why in addition to a modem, you need a communications board for telecommunications. And why IBM calls it the asynchronous communications board.

Which begs the next question: If they bother to hang the appellation "asynchronous" on that board, could there be a synchronous board? That connects to a synchronous modem? And what would such a beast be?

Yes, there could be; synchronous modems do exist, and we'll frame the answers to those other questions in a coming installment. But before you leave, here's a hint: synchronous modems don't use framing bits. ▲

EXEC DOW JONES: ALL THE NEWS IN BITS

by JoAnn Levy



A small part of the "fleet" of 300-megabyte IBM 4341 hard-disk storage units.

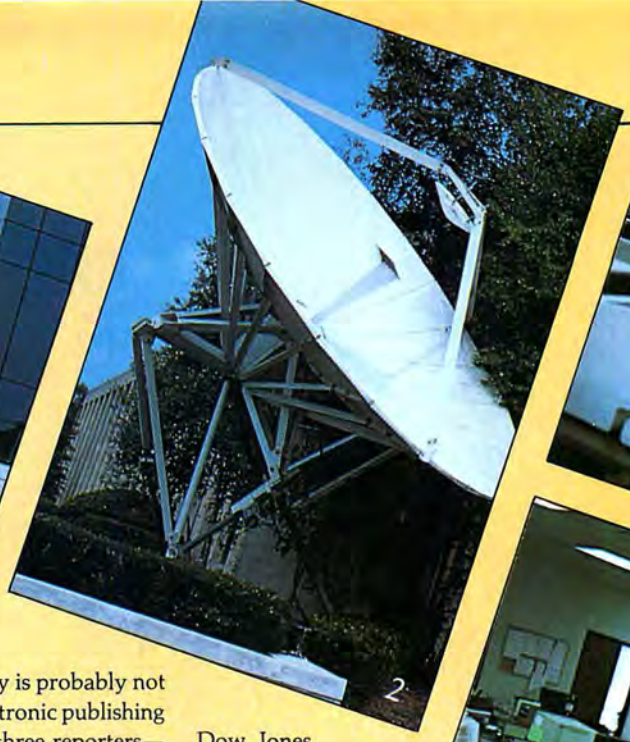
Route 1, which arrows along the edge of Princeton, New Jersey, is lined with corporate facilities set like plantation manors amid duck ponds and sculpted lawns. A long, curving driveway leads to one such structure, the darkened glass home of Dow Jones Information Services. Upstairs, a spacious office suite provides a sofa for a relaxed and expansive executive.

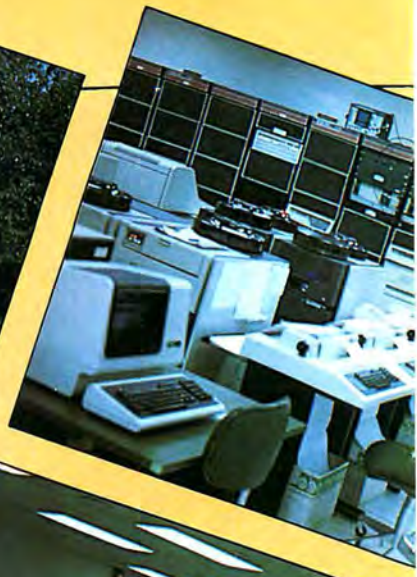
"That was pretty cheeky," admits Dow Jones Information Services president and publisher Bill Dunn, recalling the mission statement with a grin.

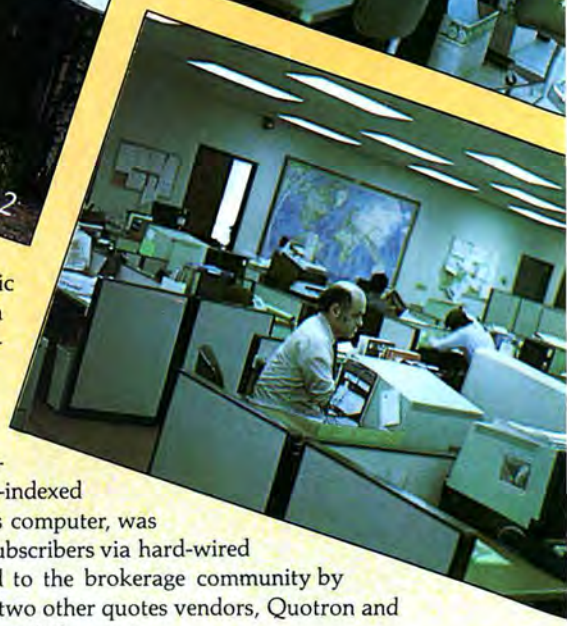
A major reorganization of Dow Jones and Company in 1980 resulted in seven operating groups."Every group had to have a mission," Dunn explains."Ours was basically that we intended to be the largest electronic publisher and distributor of electronic information.Three years ago no one else was saying anything, so we thought, why not just say we're the largest and try to be the best until somebody else can demonstrate that we have no reason to be in this marketplace?" Three years ago, when the statement was made, the Dow Jones News/Retrieval Service boasted ten thousand subscribers. By the end of this year, subscriptions to its twenty-two databases—which now include an encyclopedia, sports information, world news, weather, movie reviews, a shop-at-home service, and business and financial information—are expected to top one hundred and twenty thousand.

Dunn wouldn't be surprised by a sometime-in-the-future subscription base of ten million. "It sounds silly now," he concedes, "as silly as if in 1936 somebody had said the *Journal* would someday have two million subscribers.

"In 1936 no one was buying stocks and my dad was carrying a signboard in Des Moines, Iowa, advertising frankfurters. So who's going to







be reading *The Wall Street Journal* then?" The analogy is probably not lost on far-sighted futurists. The whole concept of electronic publishing would undoubtedly have been wondrous indeed to three reporters—Charles Dow, Edward Jones, and Charles Bergstresser.

It was in 1882 that the three formed Dow Jones and Company, the company part referring to the multisyllabic Bergstresser, whose name apparently lacked letterhead finesse. Theirs was a fairly straightforward operation, with Jones editing stories submitted by Dow and Bergstresser, and scribes handwriting one-page bulletins delivered to Wall Street subscribers by messenger.

Refinements came rapidly. By 1883, the bulletins, called "flimsies," were summarized in a two-page publication called the *Customers' Afternoon Letter,* which in 1889 became a four-page newspaper known as *The Wall Street Journal.*

Delivery by horse and buggy, while dependable, was slow. To achieve speedier delivery, the company initiated the Dow Jones News Service, which operated over telegraph wires and employed the latest technology: a printing device driven by ninety-six-pound clock weights that required winding every half hour. The device was called a "ticker."

The broadtape used in the News Service, so named to distinguish it from the narrow tape that carried stock quotations, carried business and financial news. With the advent of electricity, the clock weights became museum pieces, of course, and technological improvements continued. High-speed tickers inaugurated in New York in 1931 were capable of sixty-five words a minute.

As the years passed, Dow Jones and Company continued to be in the technological vanguard. By 1964, the company had news ticker clients in six hundred and seventy-six U.S. cities, and service kept getting faster, despite the growing amount of information to be communicated. In 1968, General Electric developed machines for computer printouts, capable of speeds of 300 words a minute, which were modified for the Dow Jones broadtape. By 1970, the printers could have been driven faster than they could have been read and offices could conceivably have been inundated with ticker tape.

"We started to get this perception of too much information," says Dunn, "yet we didn't want to restrict the flow. We just had to find a different way to present it."

For $25,000, a New Jersey research group that apparently subscribed to the dictum "If it ain't broke, don't fix it," advised against changing the system. But there was enough of a gut feeling, according to Dunn, that the company decided to go ahead and make some changes anyway.

Enter Bunker Ramo, a company that had just finished doing a major quotes project for the National Association of Securities Dealers. Bunker Ramo supplied technical and marketing expertise, and in 1971 Dow Jones pioneered electronic publishing with a news product developed from its ticker. Business and financial information, linked, categorized, and cross-indexed for Bunker Ramo's computer, was now accessible to subscribers via hard-wired terminals provided to the brokerage community by Bunker Ramo and two other quotes vendors, Quotron and General Telephone and Electronics.

Essentially, Dow Jones acted as a wholesaler to the three quotes vendors during the early seventies. "But the market was going south then," recalls Dunn, and with brokerages going out of business or consolidating, Dow Jones was losing a ticker here and a quote-vending terminal there. In response to this trend, the company came up with the idea of broadening the market for its service by making it available to corporate treasurers, controllers, and librarians.

But Bunker Ramo was hurting and didn't want to make further investments. "We knew then that we were going to get divorced," says Dunn, "so we started figuring out the value of the house and the car, and we ended up negotiating a buy-out for all the retrieval service."

Since Dow Jones was now a retailer like Bunker Ramo, GTE, and Quotron, it was in a position to sell its service to the brokerage community directly. "But," says Dunn, given that the others had invested in marketing and terminals, "it would have been unfair of us to go in and say, 'well, here's Dow Jones and you can throw those bums out.' " Besides, the quotes market was relatively small and Dow Jones was still wholesaling to the quotes vendors.

What Dow Jones wanted to do instead was to sell its service to corporations, which could access it through time-sharing terminals.

And then, says Dunn, "we got lucky." Along came Eve and Dow Jones was introduced to Apple. "We'd never heard of Apple Computers," recalls Dunn. "They were making about $70,000 a year then, instead of over a billion. And they were trying to sell hardware. We were a database purveyor, a reason people would buy their hardware. We didn't have to sell hardware in order for our information to be valuable."

In 1977, a communications package and cooperative marketing arrangement with Apple set the stage for similar agreements

1) The Princeton, New Jersey, headquarters of Dow Jones Informational Services. 2) DJ's dish antenna used for satellite data reception. 3) The room full of Digital Equipment computers is maintained by a staff of sixty. 4) The Dow Jones newsroom, where information is gathered and organized before going on-line. 5) Bill Dunn, president and publisher of DJIS. 6) Tim Turner, director of marketing. 7) Steve Bertges, product development manager. 8) Skip Grossman, head of the growing interactive cable service.

with Commodore, Radio Shack, Atari, Texas Instruments, Hewlett-Packard, Osborne, and IBM. "We couldn't do exclusives with anybody because we're a basic source of business and financial information in this country," explains Dunn. "Some people think we're a monopoly; we consider ourselves a monopoly of excellence, but there's a fine line legally on keeping basic information from the public."

Now, with business and financial news on-line, what about stock quotes? Once the work necessary for linking personal computers back to the quote source had been done, Associated Press files created for newspaper publishers could be provided to subscribers. Acting as a subcontractor for AP, Dow Jones added a stock quote in 1979. The problem was that AP, essentially a nonprofit organization run by some one thousand five hundred newspapers, wasn't measuring up.

"The response rate was horrible," recalls Dunn, "and we were selling in the name of Dow Jones." To protect that name by providing the kind of service its customers expect, the company would have to go into the quotes business. With that intent, designers created a system that could bring in information from the various exchanges, carefully edited for accuracy. "So Dow Jones was going to have a quotes service," beams Dunn, "and man, was it going to be fantastic."

But a quote is a quote is a quote. How could a Dow Jones quote differ from a quote supplied by Bunker Ramo or AP? After all, IBM opens, closes, and shows the same volume regardless of who reports it—unless some way could be found to analyze or otherwise manipulate various data with a little software, maybe something Apple Computer could publish as the Dow Jones Portfolio Evaluator.

With the 1980 reorganization, the Dow Jones Information Services became essentially an entrepreneurial group allowed to find its own way. This meant that software development, independent marketing, and technical and editorial directions could be explored by the old guard and the Young Turks within the new organization and that more people could be brought on board.

In July 1980 Dick Levine left the Washington bureau of *The Wall Street Journal*, where he'd worked for almost fifteen years, for a nonexistent editorial department in the Princeton office.

"I didn't know what to do and my bosses didn't know either," recalls Levine, from a clutter of tickers and terminals in the newsroom, now a beehive of activity with one wall lost to a huge map of the world.

One of Levine's first requests was for a typewriter. "I didn't know what I was going to do with it," he says, "but I just felt better having it around."

The first task, for which the typewriter was no help, was getting journalists and computer people to speak the same language. "And journalists had to be designers," adds Levine, "defining what we wanted to do. There were no rules and no cookbook to look into for the recipe."

And there wasn't a large pool of people with experience in the field. Levine hired one editor who'd spent a year preparing the *Columbus Dispatch* for the electronic information network Compuserve and another who'd been technology editor for the *New York Times*.

Now, some three years later, the editorial department consists of

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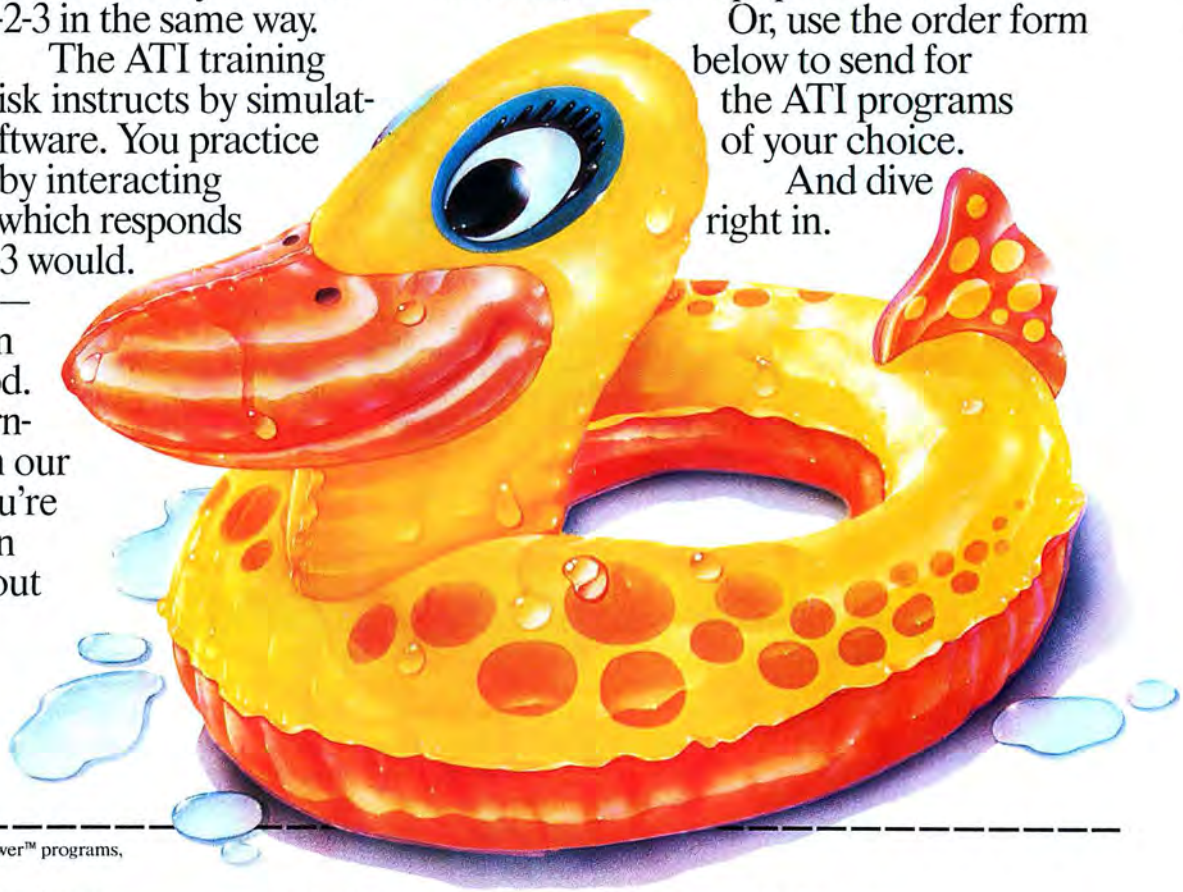

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about thirty editors, database writers, copy-readers, and news assistants. At any given moment, seven days a week, three people are "sort of monitoring the world," says Levine, in a roadside building that looks like a storefront by comparison with its black-glass parent next door. But this is where the action is.

News off the UPI wire is quickly edited, condensed, or rewritten; it is then formatted to fit CRT screens. With a push of a button it's fed to mainframe computers in an adjoining room and within minutes of its receipt on the UPI newswire it's made available to subscribers. A technical department of some sixty people provides round-the-clock monitoring of the room full of Digital Equipment computers used for processing and of a second, larger room, which looks for all the world like a laundromat, full of IBM hard-disk storage.

The initial emphasis was on adding databases valuable to the serious investor. By the end of 1980, the Media General Financial Services was on-line, offering detailed corporate financial information that by 1983 would include nearly thirty-two thousand companies, one hundred and eighty industries and fifty-two statistical indicators such as revenue, earnings, dividends, and so forth. In 1981, seven more financial-services databases were introduced, ranging from the Corporate Earnings Estimator to transcripts of *Wall $treet Week*.

Twelve databases were added in 1982, including World Report. From UPI, foreign and national news is selected, edited, and ranked in importance by News/Retrieval journalists so that subscribers can gain access to headlines, the World Report "front page," and some fifty stories a day, averaging three "pages," or screens, each.

"It's tough now to decide what databases to offer," says Levine. "In the beginning we went around knocking on doors." Now, of course, information companies anxious to get on the Dow Jones service are knocking on their door. Hundreds of database proposals have been reviewed, but the Dow Jones selection process insists on both quality and added value. "We don't want our material simply to rehash what's

SUMMARY OF DOW JONES NEWS/RETRIEVAL DATABASES

Once issued a password, users access News/Retrieval databases directly, bypassing menus, with a preceding // followed by the database name.

FREE SERVICE

Intro
//Intro
Free on-line information about News/Retrieval, including new database announcements

DOW JONES BUSINESS AND ECONOMIC NEWS

Dow Jones News
//DJNews
Stories 90 seconds to 90 days old from *The Wall Street Journal, Barron's,* and Dow Jones News Service

Free Text Search
//FTS
Search Dow Jones News stories back to June 1979 using any combination of words, dates, or numbers

Weekly Economic Update
//Update
Review of the week's top economic events

Wall Street Journal Highlights On-line
//WSJ
Headlines and summaries of major stories, including front page news, front and back page features, market pages, editorials and commentary

GENERAL NEWS & INFORMATION SERVICES

Academic American Encyclopedia
//ENCYC
Comprehensive reference, revised and updated every 6 months

Master Menu
//MENU
On-line listing of databases with instruction on how to access

Cineman Movie Reviews
//MOVIES
Reviews of latest releases are updated weekly; previews of coming attractions; reviews of old movies back to 1930s

World Report
//NEWS
Foreign and national news

Sports Report
//SPORTS
Stories, scores, stats, schedules for professional, major college, and top amateur sports

Comp-U-Store
//STORE
Electronic shopping service for more than 50,000 products; order electronically with bank cards

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//SYMBOL
Listing of more than 12,000 symbols used to access investment databases

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//WTHR
Weather tables for more than 50 major cities, national weather summary, and forecast by geographic region

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Dow Jones Quotes/Current
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Common and preferred stocks and warrants, corporate and foreign bonds, mutual funds, options, U.S. Treasury issues

Historical Dow Jones Averages
//DJA
Historical data on all four averages by specific date or 12-day period

Dow Jones Quotes/Historical
//HQ
Daily volume, high, low, and close in monthly summaries to 1979; quarterly summaries to 1978

in print," says Levine. "If we can't add value by delivering news and information electronically, we don't do it."

Internal resources are far from exhausted. Dow Jones has lots of information that may yet find its way to a screen. *The Wall Street Journal* is publishing Asian and European editions, with only limited portions available through News/Retrieval; relatively small amounts of *Barron's* can also be had on-line.

And there are plans. In coming months the full text of *The Wall Street Journal* will be offered electronically, as will an economic dictionary. And because the basic language of business is English, Levine envisions the involvement of as many foreign publishers as American. "I fully expect our service to be international in scope," he says. A case in point: An arrangement with the leading Japanese news agency is currently being developed, which will allow Dow Jones News/Retrieval to provide same-day coverage of the Japanese economy. Time differences will permit approximately forty Monday stories from Japan to be translated to colloquial English and presented on-line at 9 a.m. Monday in New York.

Sports and weather databases were added in 1981, out of the realization that in-home subscribers had other interests besides business and finance. In 1982, movie reviews and the twenty-eight-thousand-article Academic American Encyclopedia went on-line.

Grolier's, the first new encyclopedia in ten years, was designed from the outset for electronic as well as print access, and is updated every six months. "It changes the nature of what an encyclopedia is," observes Levine. "It's not static anymore." It's a news tool, for one thing. When a brave dentist named Barney Clark volunteered for a polyurethane heart implantation, the story on News/Retrieval was cross-referenced to the encyclopedia's four-page article about the artificial heart.

"We married the news item to the reference," says Levine, using a dramatic instance to illustrate his conviction that the whole of News/Retrieval should be greater than the sum of its parts.

When the Comp-U-Store shoppers' database was added in January 1983, the Dow Jones News/Retrieval staff felt concerned about the appropriateness of their organization's name; shopping was the farthest they had gone yet from the services they thought a news retrieval business should offer. However, debates on name change ceased when marketing surveys revealed that Dow Jones News/Retrieval now has recognition even by people who don't use on-line services.

What concerns Turner more is supporting the growing number of subscribers. The first means implemented was customer service; a staff of thirty was trained to answer questions about the software and the News/Retrieval service on three 800 numbers from 8 a.m. to 11 p.m. EST, Monday through Friday and 9 to 5 on Saturdays—Customer Service handled some three hundred thousand calls this year.

A long-term plan calls for off-loading high-use databases to specific geographical areas through the packet-switchers now in use: Tymnet, Telenet, Uninet, and the company's own DowNet, with nodes in Princeton and soon in New York City. Dow Jones was the first private company licensed by the FCC to own and operate satellite earth stations; these are used for *The Wall Street Journal*'s seventeen plants across the country and mainly at night. Before the decade is out, News/Retrieval will also be using this large satellite communications system.

But it's the software that more immediately serves subscribers, offering users automatic log-on capability; access to all News/Retrieval databases; and extraction of specified financial data, complete with off-line charting, graphing, and other manipulations. The initial product line developed under the Dow Jones label consisted of three investment analysis software programs, *Market Analyzer, Market Microscope,* and *Market Manager,* which were introduced to Apple users in September 1982. They were adapted this year to the IBM pc along with a new program, the *Dow Jones Reporter.*

Two packages are currently under development and scheduled for release soon. One will permit users to manipulate News/Retrieval data with *VisiCalc, Multiplan,* or *1-2-3* spreadsheets, thereby permitting individual creativity that the charting packages don't allow.

"And," says a youthful Steve Bertges, product development manager and one of Dunn's Young Turks, "we're real excited about a program that's going to let users go into the service with preformatted requests using a single command—a sort of personalized clipping service of what's happened to particular stocks—without having to rekey the stock symbols for each news item." The new package will perform a file search of the entire Dow Jones host, automatically paging through a stock's performance, estimated earnings, headlines, disclosure, or whatever has happened to that stock since the previous information request.

Bertges is excited about the Dow Jones software, Turner about the expanded and specialized customer service department, Levine about new databases, Dunn about everything. But there's another enthusiastic department, comprising only six or seven people and headed by low-key, soft-spoken Skip Grossman.

"We have interactive cable service in place in five cities," says Grossman, "and we've reached agreement with twelve operating companies. These include eight of the thirteen largest cable operators in the country, covering nearly thirty communities, with well over 1.25 million potential users."

Because Dow Jones News/Retrieval is a flat-rate service over two-way cable lines, cable subscribers, according to Grossman, use the service from ten to thirty times more than computer users. "They don't worry about how much time the kids spend using the encylopedia," he adds. "There's no issue of, 'Good grief, how much is the bill going to be?' "

While price schedules for computer access range from as much as $1.20 a minute for financial information at prime time to as low as thirteen cents after 6 p.m. and weekends, cable subscribers pay $22 a month for unlimitd access to the general news and information services and restricted access (evenings and weekends) to financial and business news, quotes, and *Journal* highlights. Round-the-clock access to everything costs $50.

Both rates include the rental fee for keyboards that Dow Jones had constructed by RCA because there wasn't any off-the-shelf hardware.

This bargain, now being snapped up in Fort Lee, New Jersey, and Clearwater, Florida, as well as in Fort Worth and suburbs of Houston and Dallas, will soon be available to folks in Grosse Point and Dearborn, Michigan, as well as some Boston suburbs. Other sites on the drawing board include Chicago, Saint Paul, Minneapolis, Tampa, Alexandria, Maryland's Montgomery County, half of Staten Island, and Orange County, California.

But whatever happened to the plan to sell Dow Jones News/Retrieval Service to corporations? Well, that's gotten off the ground too. "Fireman's Fund is using it," reports Tim Turner, "and Northwest Industries. Peat Marwick's 93 offices have it at a corporate rate. J. C. Penney's corporate computer is going to be hooked to ours. And Digital Equipment Corporation uses News/Retrieval to demonstrate the capabilities of its own equipment.

"On one side of the ledger we're kind of bullish and egotistical, but it's humbling when you figure that two hundred and fifty thousand subscribers is equal to less than four percent of the readership of *The Wall Street Journal.*"

Humbling? Don't try to tell that to the people who write mission statements with hardly less immodesty than this ad for the Dow Jones wire service published November 14, 1898, in *The Wall Street Journal*:

"Quick as a Flash! We give quotations, telegrams, cables and all kinds of news affecting the markets. Page printers are the latest electric device. News carried by electricity printed by electricity. No banker or broker can well afford to be without our Financial News Service. Dow, Jones & Co."

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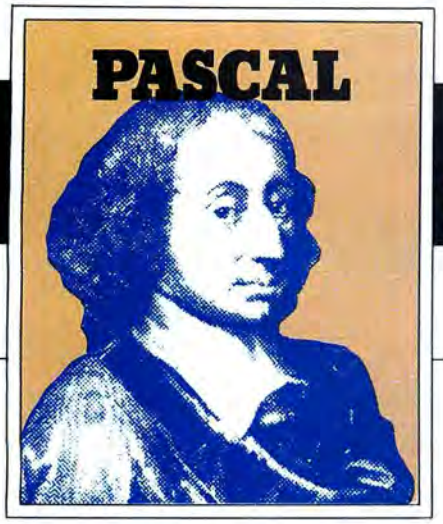


FROM BEGIN TO END

by Bruce Webster and Deirdre Wendt

Last month we introduced files as a nifty way of saving information when a program isn't running (or even when it is). Briefly put, a file is a sequential collection of a bunch of data types or structures, only one of which is actually in memory at any time. To read in a particular record, you must go to the start of the file and read the records in one at a time (using the *get* command). To create a file, you must write the records out one at a time (using the *put* command). You use *rewrite* to start writing to a file and *reset* to start reading from it. We finished up talking about *text*files. That's where we'll pick up this month.

More on Textfiles. Pascal has been accused of having lousy I/O capabilities, usually by people who know Basic or Fortran and are used to the extensive I/O formatting commands available in those languages. Actually, Pascal has extremely powerful I/O capabilities if we're interested in saving and retrieving data in binary format. However, if we want to generate text (especially text with numbers) it's not so nice. In fact, it's pretty primitive. You can still produce complicated, formatted reports; you just have to work harder.

Standard Pascal will read and write constants and variables of types *integer*, *real*, and *char*. It will also write out string constants. For example, the following are acceptable statements:

```
PROGRAM filetest;
VAR
   indx              :  integer;
   value             :  real;
   ch                :  char;
   infile,outfile    :  text;
BEGIN
   reset(infile);        {these will vary depending          }
   rewrite(outfile);     {upon the Pascal implementation    }
   readln(infile,indx,value,ch);
   writeln(outfile,'the integer is ',indx);
   writeln(outfile,'the real is ',value);
   writeln(outfile,'the character is ',ch);
   close(infile);        {these will also vary              }
   close(outfile)
END.  {of PROGRAM filetest}
```

(As noted last month, the actual commands to open and close a file vary according to which Pascal implementation you are using.)

If the input file for this program contains the line

```
421 52.3 +
```

then the output file will contain

```
the integer is 421
the real is 52.3000
the character is +
```

More on Textfiles

Most implementations of Pascal do contain some formatting capabilities. For integer and real values, we can specify a total field size, using the convention *p:n*, where *p* is the variable (or constant) and *n* is an integer value indicating the field width. For example, the following two statements

```
writeln('this is a narrow field  :  ',indx:3);
writeln('this is a wider field   :  ',indx:15);
```

would produce

```
this is a narrow field  :  421
this is a wider field   :            421
```

For real values, a second value can be given: the number of digits after the decimal point. The format is *p:n:d*. Note that $n >= d+2$, since room must be allowed for the decimal point and the sign (if any). These two statements

```
writeln('this has no end field  :  ',value:6:0);
writeln('this has a wider field :  ',value:6:2);
```

would produce

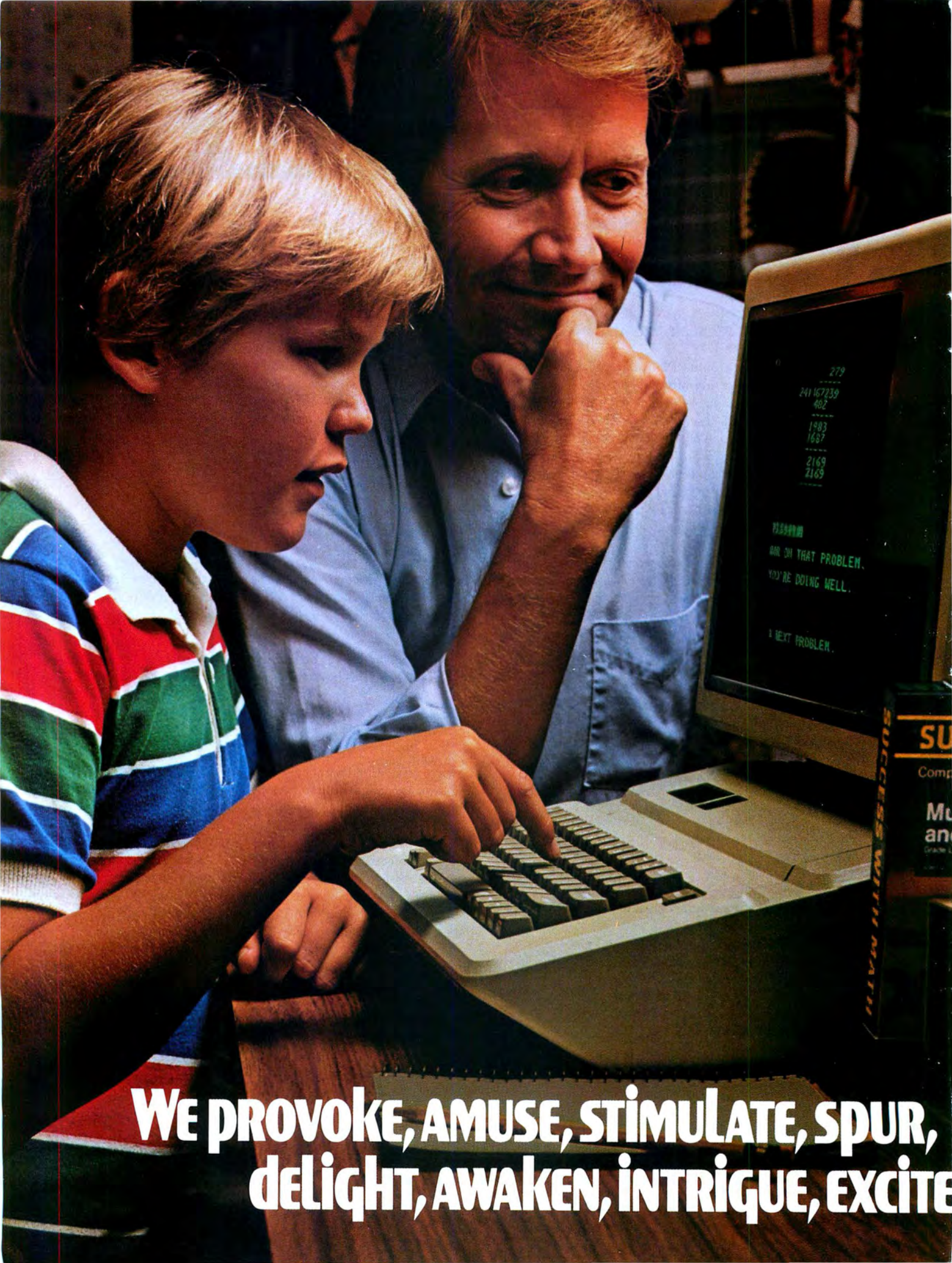
```
this has no end field  :  53.
this has a wider field :  53.30
```

Most versions of Pascal have some sort of character strings and allow string input and/or output. Some even allow field width specification on string output. However, we'll leave these matters to a later column, where we'll discuss strings.

Interactive I/O. Those of you with your thinking caps on may have noticed a potential problem with textfiles. As mentioned last month, when the *reset* statement is executed, the file is opened and the first record read in. Well and good. What happens, though, if the file we're reading from is not on disk but instead is the keyboard itself? Nothing is there to be read in, and (usually) an error results.

To get around this, both UCSD and IBM Pascal have a special type of textfile for interactive input. UCSD calls such a file *interactive*, while IBM says that it's of type *terminal*. Both automatically define the files *input* and *output* to be of that type. Both also automatically *reset(input)* and *rewrite(output)*, with the former reading from the keyboard and the latter writing to the screen. Finally, any *read* or *readln* commands not specifying a file read from *input*, while any *write* or *writeln* commands without a file write to *output*. We could modify our program to work interactively by writing:

```
PROGRAM intertest;
VAR
   indx              :  integer;
   value             :  real;
   ch                :  char;
```



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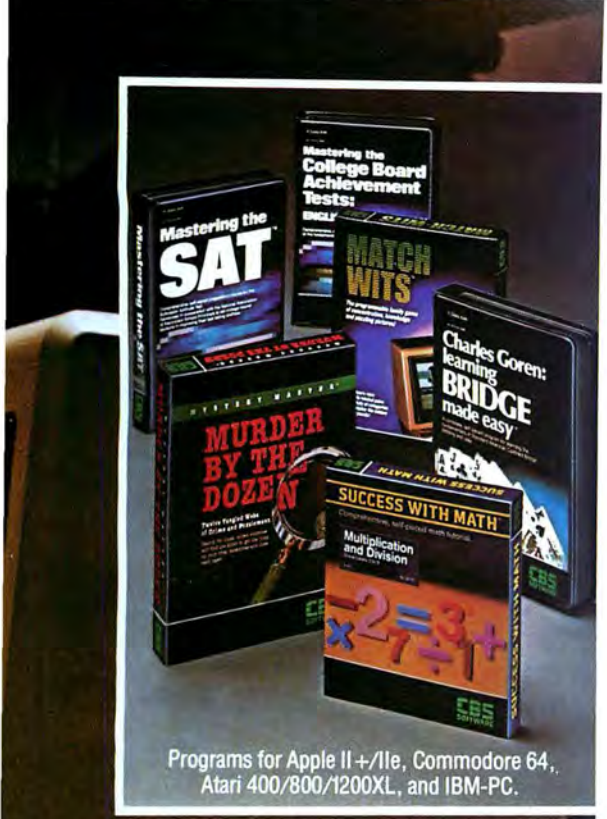

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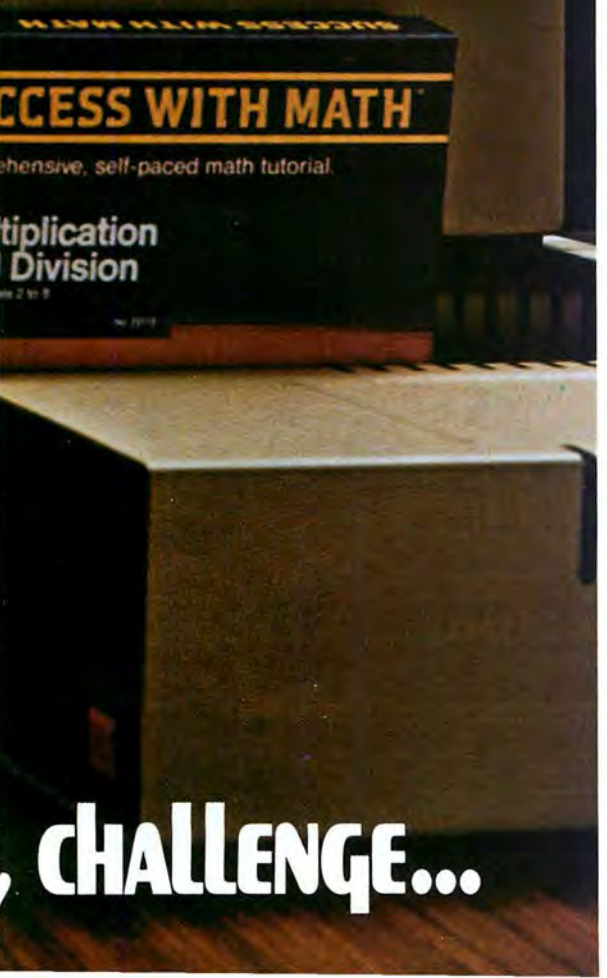

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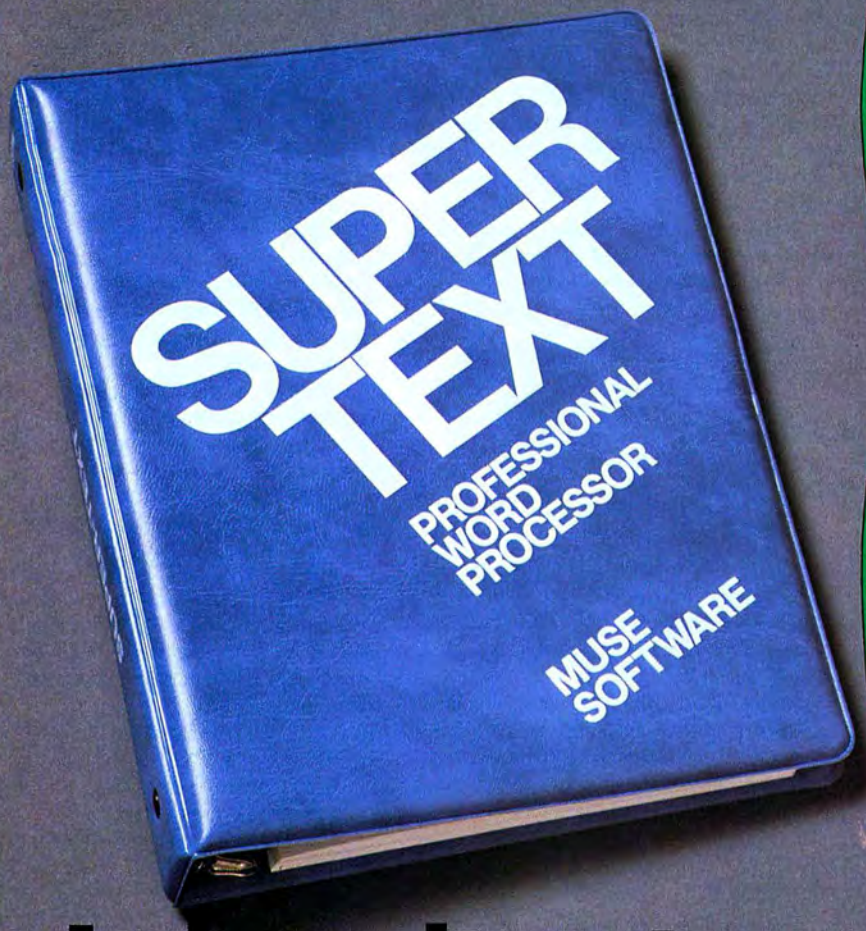
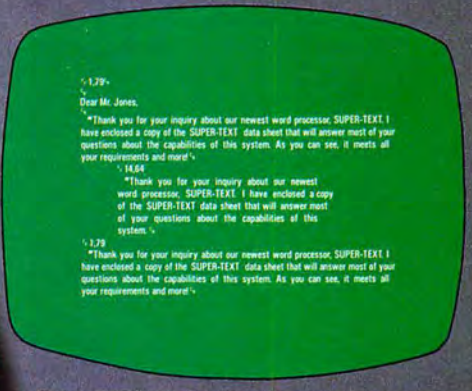


ON-LINE "HELP"



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```
BEGIN
   write('Enter the integer value :  '); readln(indx);
   write('Enter the real value    :  '); readln(value);
   write('Enter the character     :  '); readln(ch);
   writeln('the integer is ',indx);
   writeln('the real is ',value);
   writeln('the character is ',ch)
END. {of PROGRAM intertest}
```

After we'd run this program, our screen might look like this:

```
Enter the integer value :  15
Enter the real value    :  3.14
Enter the character     :  j
the integer is 15
the real is 3.14000
the character is j
```

A Last Note on Textfiles. Last month, we talked about the Boolean function *eof(f)*, which tells us when we've reached the end of a file. However, textfiles have an additional delimiter: the end of a line. At times, we may want to read in a line item by item and know when we've hit the end of the line. How can we tell? By using the Boolean function *eoln(f)*, which tells us just that.

Let's suppose that we have the following textfile:

```
342 3 1123
41 1772 1 2 33 5
65
441 233 23 67
```

We don't know ahead of time how many numbers there are on a line, but we still need to read them in. The following chunk of code will read them into an array:

```
PROGRAM eolntest;i
CONST
   nummax          =50;
VAR
   infile          :  text;
   numlist         :  ARRAY[1..nummax] OF integer;
   numcnt          :  integer;
BEGIN
   reset(infile);        {again, this will vary                }
   numcnt :=0;           {nothing in array yet                 }
   WHILE NOT eof(infile) AND (numcnt < nummax) DO
   BEGIN
      WHILE NOT eoln(infile) AND (numcnt < nummax) DO
      BEGIN
         numcnt :=  numcnt + 1;
         read(infile,numlist[numcnt])
      END;
      readln(infile);    {read in end of line                  }
   END;
   FOR indx :=  1 TO numcnt DO
      writeln('numlist[',indx:2,'] = ',numlist[indx]:5);
   close(infile)
END. {of PROGRAM eolntest}
```

In the innermost loop, we read numbers off a line, one by one, until we hit the end of the line (*eoln*). We then advance to the next line (using *readln*) and continue the process until we either hit the end of the file (*eof*) or have filled up the array (*numcnt = nummax*). At the end, for a check, we write all of the values out to the screen.

Random Access to Files. As we saw last time, to read or write a particular record in a file we must go to the start of the file and work from there. If we wish to read the tenth record in a file, we must reset the file and go through the first nine records to get to the tenth. If we want to modify the tenth record, we must read it in as mentioned, reset the file, read in the first nine, then write the tenth back out. In short, a lot of work.

Now let's suppose we want to sort that file in some way. Our sorting program would have to do a lot of reading from and writing to the file, using the clumsy procedure just described. If the file is small enough, we can read the entire thing into memory, sort it there, then write it back out. If it isn't, we're in for a long, tedious program.

Our task would be easier if we could read and write any given record in the file without having to go back to the start and read all the preceding records. Since this is such a desirable trait, most versions of Pascal offer some sort of direct or random access capability (called "random" because records can be referenced in any order instead of only sequentially). One common form of this ability is a *seek* statement, taking the form

```
seek(f,n);
```

where *f* is the file variable and *n* is an integer variable or expression indicating the record number. After such a statement, *get(f)* will fetch the nth record, while *put(f)* will write the data in *f*^ out to the file. That, basically, is it. Since the details of random file access tend to be specific to a particular version of Pascal, we'll leave it to you to dig up more details.

Conclusion. We hope we've given you enough about files to get you started. However, since each version of Pascal has its own peculiar ways of handling files, we'll have to cover each version in detail. Next month, we hope to show you the ins and outs of UCSD and IBM Pascal, and (possibly) Pascal MT+ as well. See you then. ▲

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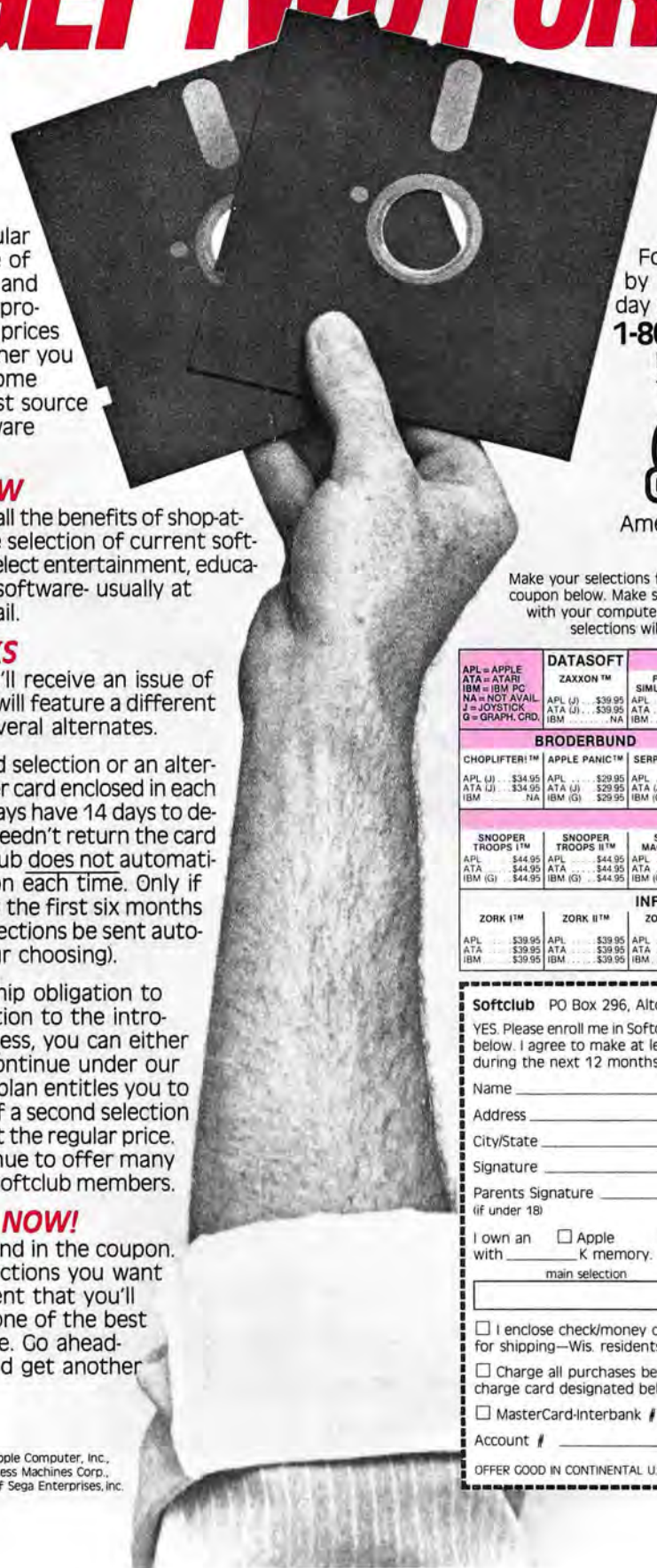

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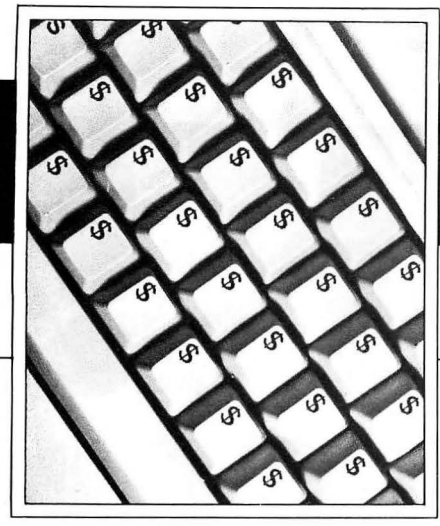

MICRO FINANCE

by Ken Landis

The Bottom Line

Sometimes business decisions are difficult to make. Often, the best strategy is to rely on a combination of factors—gut feeling, or intuition based on your own experience, and concrete, detailed financial analysis.

With that in mind, we'll look this month at Ashton-Tate's *Bottom Line Strategist*, a program designed specifically to help you analyze the financial and marketing problems your business faces. Its authors suggest that *BLS* can be a useful tool in analyzing pricing strategies, developing a business plan, coming up with a financial or marketing proposal, making capital budgeting decisions, evaluating investment opportunities and financial risks, analyzing the viability or profitability of projects, structuring projects to maximize profits, determining the break-even and payback points of projects or investments, and assessing competitors' financial and marketing strategies.

BLS is a menu-driven analysis tool. Its purpose is to help you integrate and analyze key business assumptions in seven major areas: revenues and costs, marketing and advertising, learning curve time, cash flow, inflation, depreciation accounting, and net present value. We'll examine how each area works and describe the kind of information the program requests, and then we'll describe and evaluate the kinds of analysis it offers.

BLS requires specific information about your key business assumptions, as well as various marketing and financial information. Once you've supplied what's needed, *BLS* is ready to help you analyze the potential impact and profitability of your business decisions. Basically, all you need to do to use the program is boot the disk and follow the instructions; neither programming knowledge nor computer knowledge is assumed.

To illustrate how *BLS* works, we'll use (and enlarge upon) an example from the program documentation. Once we've walked through this example, we'll be in a position to consider the program's strengths and features as well as its weaknesses and limitations. Unfortunately, some aspects of the way the program is set up have the effect of significantly limiting its applicability as a financial planning and decision-making tool. More on this later.

The company we're concerned with is called Thomas Time Sharing, Inc. (TTS). TTS is getting ready to provide an electronic advertising and transaction exchange service for corporations. But before the plans can be set in motion, the company must arrive at a pricing policy.

It's been estimated that starting this business will require $384,823 over an eight-month period. The recurring costs for operating the business include human resources (payroll), computer resources, telecommunications charges, administrative costs, office overhead, and ongoing research and development. The constant, or fixed, portion of these costs is estimated to be $23,253 per month. If a transaction is handled manually by a member of TTS's staff, the estimated cost per transaction is $4.61. If a transaction is entered directly by a member of the service, TTS incurs no transaction cost.

Recently, TTS's backers commissioned a market research study to gauge the potential market for the company's services. This research indicates that the market's full potential is 5,000 corporate customers, each of whom can be expected to use the service approximately ten times per month. TTS expects to sign up fifty corporations at the beginning of the venture and after twenty-two months of sales, the company expects to have 2,500 active corporate customers.

The research also rated the potential effectiveness of advertising to promote the service. The marketing/advertising "reach" that applies to this particular industry—that is, the dollar amount of revenues generated for each dollar spent on advertising—is estimated at 2.0. A simple rule of thumb: the higher the reach the better.

As mentioned earlier, our task is to decide on a pricing strategy for TTS. The alternative strategies to be evaluated are charging based on usage, charging according to a one-time subscription or accreditation fee and allowing limited access, or charging based on a combination of these two strategies. If we do decide to charge on an accreditation fee, we must also decide how frequently we'll bill. Should we collect yearly, quarterly, monthly, or once at the point of accreditation?

Bottom Line Strategist has eight different input screens; we'll discuss each of them as we enter the required data. With the information from the marketing study in hand, and knowing the assumption required by *BLS*, we're ready to use the program to help us analyze our alternatives in the example situation.

The first input screen covers business growth assumptions. We're prompted to enter the business development period (eight months), the number of customers at the beginning (50), the maximum number of customers in a given month, which is the market's potential (5,000), our estimate of the time required to reach 50 percent of maximum sales (22 months), and the number of expected sales transactions per customer per month (10).

Input screen two is where we enter marketing and advertising assumptions. The revenue saturation level is the first piece of information that must be supplied. Revenue saturation is equivalent to the maximum amount of revenue that can be generated in one month. We'll enter a fictitious number, $10 billion, so that the program will ignore the marketing saturation effect as the number of customers increases. By doing this we can find out what the maximum marketing expenditures could be.

The marketing reach (2) is entered next. The program now asks what estimated proportion of sales per month would be lost if marketing were stopped. Our estimate put this figure at 10 percent. This "drop-off" rate helps the program determine what would happen to sales if marketing expenses were cut off to conserve cash flow. Understanding the potential deterioration in sales that could occur if marketing expenditures were cut back will help us develop a contingency plan.

The advertising-revenue reach time lag must also be entered. This time lag is the delay

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The next thing you should know is that if the TK!Solver program can't make life with your personal computer easier (and pay for itself), even if you use it only 15 minutes a week, you are a very rare person.

And finally, you should know exactly what equation processing is, and how it works. If you keep reading this, you will.

Equation processing with TK!Solver, or problem solving made easy. The best way to understand what the TK!Solver program *is*, is to understand what it *does*. The following simple example is designed to do just that. If you're still a little in the dark after reading it, stop in at your local computer store for a very enlightening hands-on demonstration.

Begin by setting up your problem. The TK!Solver program lets you do it quickly, easily, and naturally. For example, a car costs $9785. What would be the monthly payment on a three-year loan if the down payment is 25% and the interest rate is 15%?

STEP 1. Formulate the necessary equations to solve your problem and enter them on the "Rule Sheet" simply by typing them in (as in the screen photo). For example: "price−down = loan."

STEP 2. Enter your known values the same way on the "Variable Sheet." For example: "9785" for price. You may also enter units and comments, if you want.*

STEP 3. Type the action command ("!" on your keyboard) to solve the problem.

STEP 4. TK!Solver displays the answer: the monthly payment is $254.40.

Backsolving, the heart of TK!Solver. Now that you've defined the problem and solved it, TK!Solver's unique backsolving ability also lets you think "backwards" to solve for any variable, regardless of its position in the equation. For example, if you can only afford a monthly payment of $200, you can re-solve the problem in terms of that constraint. The TK!Solver program will solve the problem, displaying your choice of a higher down payment, a longer loan term, or a lesser interest rate. This unique backsolving capability forms the basis of TK!Solver's remarkably flexible problem-solving ability.

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Also, as you can see from the example on the screen, TK!Solver deals not only with single variables, but with entire equations and sets of simultaneous equations. It also deals with much more complicated problems than this one. How complicated? That's up to you. What kinds of problems? That's up to you, too, but popular applications include finance, engineering, science, design, and education.

Other extremely useful and interesting things TK!Solver does. Aside from its basic problem-solving abilities, the TK!Solver program performs a number of pretty fancy tricks. Like: *Iterative Solving;* in which TK!Solver performs successive approximations of an answer when confronted with equations that cannot be solved directly, (like exp (x) = 2 – x • y and sin (x • y) = 3 – x – y). Like: *List Solving;* in which TK!Solver attacks complete lists of input values and solves them all, allowing you to examine numerous alternative solutions, and pick the one you like best. Like: *Tables and Graphs;* using the values you produced with the List Solver, the TK!Solver program will automatically produce tables and graphs of your data. You can look at your formatted output on the screen or send it to your printer with a single keystroke. And like: *Automatic Unit Conversion;* in which TK!Solver lets you formulate problems in one unit of measurement, and display answers in another. Very convenient what with all this talk about going metric.

The TK!Solver program also provides a wide variety of specialized business and mathematical functions like trig and log and net present value.

Then, there's TK!Solver's on-screen Help facility that provides information on commands and features any time you want it. Just type "?" and a topic name.

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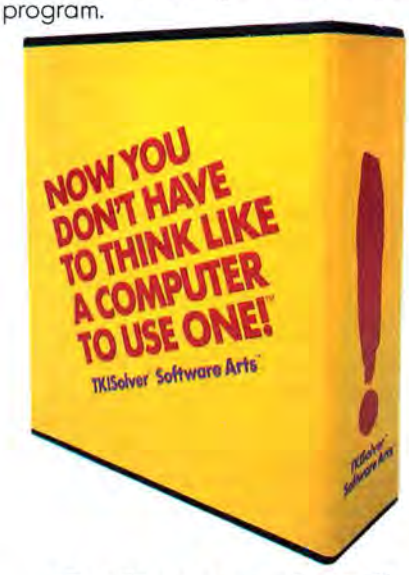

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between our marketing effort and the revenue it generates. In this example, the time lag is estimated at two months: Spending a dollar on advertising today will generate two dollars in sales (the amount spent on advertising multiplied by 2.0, the reach factor) two months from now.

Every start-up business has one overriding, critical concern: Will cash flow cover expenses? The third input screen is concerned with a business's cash outlay assumptions. It's here that we enter the initial cash investment we're planning to make in our business. For TTS, this start-up amount is $384,823.

The fixed portion of recurring monthly costs is entered next. These are the expenses that will be incurred whether one or one million transactions take place in a given month. (TTS's fixed recurrent costs are estimated to be $23,253.) Variable unit costs—the costs involved in producing or providing each kind of unit—must also be entered, since this allows the program to calculate how much it costs to provide an entire product. (TTS's variable cost per unit is $4.61.) Variable costs are a very important aspect of cash flow planning that it's easy to overlook. A business must be able to cover not only its fixed recurring costs, but also its costs per item as sales grow. To repeat an old retailing adage: "Business was great, but we couldn't afford to keep the doors open!"

BLS is set up to handle both service and manufacturing industries. In a manufacturing environment, there's typically a lead time between the receipt of the order, when it is produced, and when it finally reaches the customer. *BLS* accounts for this lead time in its calculations. But for the TTS example, and for most service industries, lead time is not common, so for present purposes we'll assume a lead time of zero.

Input screen four deals with pricing policy. What will we sell our products for? This is the heart of the TTS problem. *BLS* can analyze subscription fees, transaction charges, or a combination of the two. And it can analyze various different pricing strategies to see how they affect the overall financial picture.

The program can also analyze the effect of aging the business's records. The aging, or collection, period is another critical assumption for a business. If you sell a product today, you incur costs today. You have to give the buyer the product or service, take the time to sell it to him, and so on. If you don't get paid for sixty days, you must be able to "carry" the cost of the merchandise, and the expenses associated with selling it, for that period of time. Not only do you need to be able to lend the customer money (which is, in essence, what you're doing), but you must take this opportunity cost—the cost of lending the money to the purchaser—into account. *BLS* helps you do just that, using the collection period information and a cost-of-capital or borrowing cost figure you provide in a later screen.

It's also important to figure in the amount of "learning curve time" that workers or providers of a service will need to get up to speed in producing goods or providing services. After all, the amount of labor that goes into any product or service helps determine its cost, and neglecting to figure in this necessary learning time can make or break a company or a new product. We've decided that no extra time is required in order to get up to speed at TTS, so we'll put a zero in response to the prompt that asks for the "portion of variable costs that decreases with productivity." The learning coefficient, then, is 100 percent. A 100 percent coefficient indicates that workers are operating at maximum speed and efficiency beginning at day one.

Inflation's Impact. Inflation is part and parcel of American life, and business people who do not account for it don't usually have a business to account for for very long. *BLS* requires that three key inflation assumptions be entered in the sixth input screen.

The first assumption to be entered is the estimated annual rate of inflation, which we'll assume to be 10 percent. The second assumption is the amount of inflation we feel that TTS can pass along to customers each year through price increases. We expect to be able to pass one-half of the inflation rate (5 percent) on to customers each year. Depending on the price sensitivity of our service, we may lose some customers when we do this, and we must also take this possibility into account. Price sensitivity is determined by the economic elasticity of the goods or services provided. (For a more complete explanation of this phenomenon, check a macroeconomics textbook and be prepared to get confused. The *BLS* documentation also provides an explanation of elasticity.) The third assumption we must supply in screen six is the yearly increase in costs as a percentage of the annual rate of inflation; for TTS, it's estimated at 84.8 percent.

Depreciation. Accountants account for money in what may appear to be strange ways. Depreciation is one of those things that seem peculiar, but it actually makes a lot of sense. If you don't understand what depreciation is and how it works, get hold of a basic accounting text. Learning how depreciation works will be well worth your time.

The bottom-line effect of depreciation is that it shelters income by providing an income tax deduction. Tax shelters normally have very high depreciation components (preferably, but not necessarily, coupled with some income). The TTS example involves no depreciation considerations, but we'll cover the program's depreciation prompts anyway to gain an understanding of what *BLS* can handle.

BLS can analyze three forms of depreciation: straight line, double-declining balance, and sum-of-the-year's digits. Different depreciation formulas, or ways of calculating depreciation, affect the amount we can write off each year. The three differ in the speed with which they write off, or depreciate, an asset. What's the advantage of writing off an asset very fast? Well, a dollar today is worth more than a dollar tomorrow, so the faster you depreciate, the more the money is worth to you.

At screen seven, *BLS* requires us to supply the depreciation method we're going to use, any factors needed to perform the calculations, the starting book value or the purchase price plus other allowable expenses, the salvage value (what the asset will be worth at the end of its useful life), and the life of the asset.

The final input screen is the place to enter the cost of capital, the investment horizon or time information, and corporate tax information. The cost-of-capital formula used by *BLS* employs a weighted average of the cost of both debt and equity capital. This can be a tricky number to come up with, but its importance is clear: The cost of capital assumption affects both the cash flow of a business and its net present value. Therefore, every effort should be made to be as accurate as possible. TTS's cost of capital is 20 percent after taxes, and the forecasting, or investment, horizon is sixty months. For this example, we want to estimate what the pretax net present value of TTS will be, so we'll set the corporate tax rate variable to zero.

Once we've entered cost-of-capital information, we've supplied all the data *BLS* requires. We can now begin our analysis of profitability and the tax shelter situation by choosing the forecast option from the main menu. The program displays the results of its analysis on the screen in tabular form. You can let this information scroll by, or you can start and stop it by hitting single keys.

BLS generates (and displays on-screen) a number of reports, including a sales and marketing analysis report, a financial analysis report, a tax shelter information report, and a four-part summary report.

The sales and marketing analysis report shows our projections for the number of customers, the total revenues, and the marketing costs over the time horizon we chose earlier. This report provides some quick and dirty numbers to use when dealing with bankers and accountants when discussing our business plan or attempting to bear out a gut feeling.

The financial analysis report can be considered the "acid test" for a business. It merges the revenue and cost information we entered earlier and produces cash flow and net present value projections. At the end of each month we can look at the business's cash flow and its overall net present value to date. This report also shows the break-even date—the date on

which the business will begin to turn a profit. If the net present value is less than the return we could get by putting our money elsewhere, then what we've learned from this program is that TTS is not the optimum investment.

From the next report, we learn the book value of our firm's tangible assets, the depreciation tax shelter figures (telling us how much income we can shelter from taxation), and information on the impact of depreciation on the net present value of the business (the return on the business after evaluating tax and accounting considerations).

When calculations are complete we get the summary report, which tells us the computed maximum number of customers per month, the sales per customer per month, and the month of maximum sales growth. Displayed in the bottom right hand corner of the screen is the pricing policy information we entered earlier on screen four.

The top right half of the screen shows the maximum cash flow at the final month of the projection—the point in time at which the business becomes profitable, and the minimum cash flow deficit, with the month in which it occurred.

The bottom right half of the screen displays minimum and maximum after-tax net present value. The points at which these occur are key times in life of the business. At the time when the maximum net present value after taxes is reached, the business has achieved its highest return. Conventional wisdom tells us that this would be the best time to sell out. The minimum net present value and the month when it occurs will show the maximum percentage loss you could sustain using this set of assumptions. The break-even month—the point at which the business is not only turning a profit but has made enough overall to cover the start-up costs—is also calculated and displayed. For many business situations, this number is the big one. It shows when a business is not only making money but has made enough to pay back investors.

All the reports *BLS* displays on screen can be printed out (provided you have a printer that can produce at least 120 columns) in a slightly different form from what's been described here. If you're preparing a presentation for a bank or for potential investors, these reports could prove helpful. They give a clear representation of your view of the business over time. But be sure your assumptions are realistic; if they're not, the picture you paint with *BLS* won't be either.

BLS can also generate, display on screen, or print out eleven different graphic reports (or charts) based on its analysis. Your printer does not have to be graphics-capable. And since the program uses block graphics characters for its charts instead of high-resolution screens, it works just fine with the standard printer/monitor adapter and a monochrome display; a color/graphics board is not required.

The reports *BLS* produces cover number of customers, number of sales, total revenues, marketing and advertising costs, total costs, cash flow, net present value before tax shelter, book value of assets, depreciation of tax shelter, contribution of tax shelter to net present value, and net present value after tax shelter. Any one of these charts can display monthly data, month-to-month change, month-to-month percent change, or cumulative data. A useful "zoom" feature allows you to position the cursor anywhere along a chart and then to magnify, or zoom in on, that section.

How will all this number gathering and analysis help us make decisions? Figure 1 shows a chart that was constructed using the results of *BLS*'s analysis of the TTS information we provided. This chart makes it easy to see the effects of different pricing strategies on cash flow, payback, break even, and net present value. The most noticeable result is that strategy number two, the pay-as-you-use-the-system pricing would not be profitable, so out the door it goes. Various other strategies remain to be evaluated. Which one is best? *BLS* won't tell you; its purpose is to help *you*

BUSINESS SCENARIOS		CASH FLOW					NET PRESENT VALUE			
SCENARIO AND PARAMETERS	SCENARIO NUMBER	MAXIMUM CASH FLOW DEFICIT		PAYBACK IN MONTHS	MAXIMUM CASH FLOW		MINIMUM NPV		BREAK-EVEN MONTH	NPV AT MONTH 60
		$	AT MONTH		$	AT MONTH	$	AT MONTH		$
YEARLY ACCREDITATION--REFERENCE SCENARIO ACCREDITATION FEE = $1,500 PRICE PER TRANSACTION = $5	1	-85,603	7.0	12.7	641,052	57.0	-405,955	8.0	21.6	10,989,409
PAY-AS-YOU-USE-THE-SYSTEM NO ACCREDITATION PRICE PER TRANSACTION = $5	2	-54,026	30.0	NO PAYBACK	-16,522	60.0	-2,181,512	60.0	NO BREAK-EVEN	-2,181,512
PRICE PER TRANSACTION = $10	3	-50,603	7.0	27.0	220,419	60.0	-739,897	28.0	41.6	1,781,744
PRICE PER TRANSACTION = $20	4	-53,103	7.0	19.6	694,298	60.0	-549,984	20.0	30.1	9,708,216
PRICE PER TRANSACTION = $50	5	-60,603	7.0	13.5	2,115,922	60.0	-464,984	13.0	23.1	33,487,304

Figure 1. Pricing Strategy Chart using *Bottom Line Strategist*

analyze your business decisions, not to make decisions for you.

Some Significant Reservations. The main value and strength of this program is that it helps you structure your thinking and analysis. It gives you a baseline picture of what a business situation looks like and helps you quantify your assumptions. But this structured approach is also the program's primary drawback and weakness in the long run. The analysis is very rigid and does not allow you to change your assumptions over time. This means that your analysis, and the conclusions you form based on it, may not be realistic.

Some specifics will help clarify the problem. One obvious example—your business doesn't necessarily grow at the same rate each year; its growth varies. Neither do your expenses stay the same; they certainly change over time. And neither do your taxes remain constant. We have a graduated tax system, and this means that the more profit you make in a year, the higher your taxes will be, up to a maximum. A realistic analysis requires the ability to vary your assumptions over time, and that's exactly what *BLS* doesn't allow.

BLS's maximum time horizon is five years. For some businesses that's plenty of time, but for others, especially those that are capital intensive, five years is not enough. So before you decide to use this program, you must determine whether you can live with this limitation.

One way of coping with this deficiency would be to adjust the analysis manually and play with it on a spreadsheet, but, of course, this would defeat the whole purpose of the program. A more practical way of coping is to be clear in your own mind that these problems exist and then adjust accordingly.

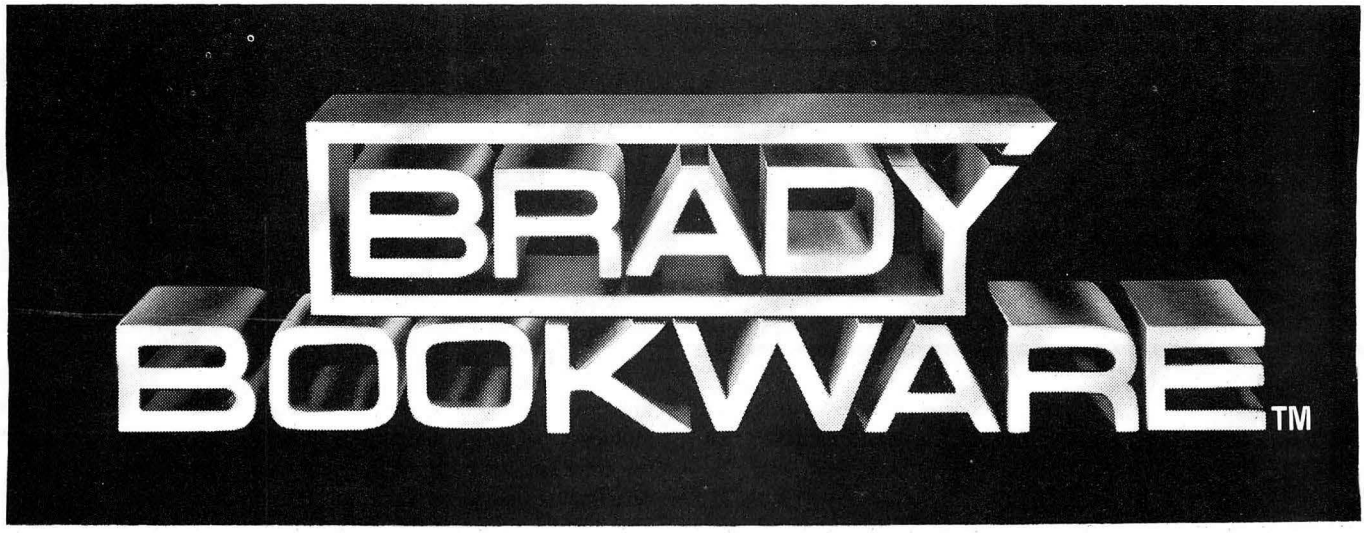
In addition, the program doesn't take investment tax credits into account. Also of significance—it doesn't handle tax loss carryforwards or interest payments. Another drawback—the program depreciates all equipment identically, rather than allowing you to figure in different depreciation times. This can significantly skew *BLS*'s picture of your business. Furthermore, it makes the mistake of expensing the entire cost of capital equipment during the first month you own it and then going on to depreciate it. This means, in effect, that you're writing capital equipment off twice.

Documentation. The *BLS* documentation leaves a good deal to be desired. Fortunately, the program itself is nearly self-documenting. And except for its data-handling utilities, it's easy to use. (All file loads and creations are done through DOS; this setup is annoying to say the least. Once you've started working with a program, it shouldn't be necessary to leave it, get a data file, and then restart.)

Two sections in the documentation do provide good background material for the user: A glossary covers the key terms used in the *BLS* program, and an appendix called "Financial Framework" gives a clear indication of the theoretical underpinnings of *BLS*'s analysis. (It's a very good idea to read this section of the documentation before you purchase the program. That way you can make sure you understand what the program does and how it does it.) The documentation also contains an appendix that lists valuable reference materials covering the various functional areas and techniques.

BLS forces you to structure your analysis of a business problem and won't let you forget to include an important assumption. It also has the potential to save you countless hours of spreadsheet programming and graphics generations. But the shortcomings we've mentioned, as well as various subtle irregularities (such as the fact that it doesn't account for the different tax treatments given to interest payments versus dividends and does not reinvest positive excess cash flow at a risk-free rate) limit the program's usefulness.

Used by a person who is unaware of its idiosyncrasies and limitations, *BLS* has the potential to create as many problems as it solves. It is therefore not a program for the weekend financial analyst. But if you know where you want to go, how you want to get there, and how much money you want to make, *BLS* can be, within its limitations, an effective analytical assistant. ▲



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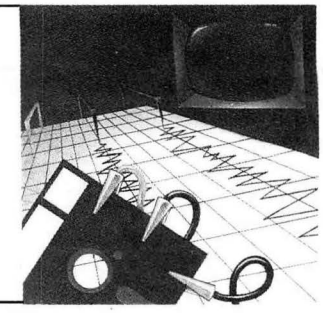

Unless otherwise indicated, software listed runs in DOS 1.1 or 2.0 with either display adapter and requires 64K and at least one disk drive.

SPF/PC

This is a full-screen editor that really makes editing data a pleasure. Haven't heard many people who use a line editor make that statement, have you? Using a line editor is tedious. You have to identify the line to be changed, isolate it, make the change, and then incorporate the changed line back into the text. With a full-screen editor, you position the cursor wherever data needs to be altered and enter changes directly into the body of the text. *SPF/PC*, a first-class example of a full-screen editor, is a valuable, well-thought-out tool for either business or personal users who edit any kind of data on the pc.

SPF/PC is modeled after IBM's mainframe editor *ISPF (Interactive Screen Productivity Facility)*, and it closely mimics the functions of *ISPF*. This similarity to the older program makes it especially easy for businesses currently using *ISPF* and now acquiring pcs to bridge the gap between mainframe and micro.

Not every feature of *ISPF* is incorporated into *SPF/PC*. *ISPF* has a line-down key to skip from line to line as well as a separate enter key. However, because of the pc's keyboard design, *SPF/PC* is forced to use the enter key for both the line-down and enter functions. Placing a D on a line for deletion and pressing the enter key immediately deletes the line. There is no chance to change your mind once you've pressed enter.

On the other hand, *SPF/PC* has some new and powerful commands that are not included in *ISPF*, such as *transfer* and *check;* these should prove to be extremely useful.

SPF/PC commands come in two flavors: primary and line. Primary commands, which you enter in a command input field at the top of the screen, include the usual *find, change, move,* and *copy,* as well as the following special commands: *caps,* which forces all entered data to capital or small letters; *create,* which builds a new file from selected parts of the data currently being edited; and *check,* which examines the data for valid ASCII characters—an important consideration if the text is to be used in telecommunications. Line commands, which are entered over the sequence line numbers, consist of the vanilla *move, copy, delete,* and *repeat line,* as well as commands to perform block functions, copy with overlay, set variable tabs, define field boundaries, and shift data left or right.

SPF/PC gives you four-way scrolling by full page, half page, current cursor position, or number of lines. The horizontal scrolling allows you to edit data lines as long as 240 characters—including Basic programs that have been saved with the ASCII option. If you use a full-screen editor to edit Basic, you should be aware that if you swap or duplicate lines, you need to renumber manually the altered lines so they will be handled properly by the Basic interpreter. If the interpreter encounters two line 100s, for example, it will act only upon the last one it finds.

If while editing a file you find that you need to work on another file at the same time, no problem. *SPF/PC* has a split- or dual-screen function. You can perform two separate tasks, switching from one to the other, by pressing F4. The *transfer* command allows you to copy data from one screen to the other while in split-screen mode.

SPF/PC is fully menu-driven, and the main menu lists the following options: *browse, edit, utilities,* and *help.*

The utilities option displays a sorted directory and lists all pertinent information (file size, date, and time). This option can also handle the wild card and global characters. Another handy utility is the disk drive cleaning support, which requests that you enter a drive and amount of time (in seconds). Your own favorite disk cleaner can be inserted into the selected drive, and upon pressing enter the drive will spin the cleaning disk for the desired time. Printing, renaming, copying, deleting, and moving files can also be accomplished within the utilities section.

The help option supplies its own menu of help facilities, and at any time you can press the F1 key to provide instant on-screen help.

SPF/PC requires a minimum of 128K and operates on both monochrome and color displays as well as on RGB monitors. An important consideration for businesses is that the screen colors closely duplicate the color combination used on a 3279 mainframe terminal. The menu text displays in red, the background is black, headings are a light brown, and text data are green. While a monochrome display is usually

best for text work, a good color monitor can be used. Constantly located at the bottom of the screen is a status line telling you how much usable memory remains, whether there is data beyond the edge of the screen, if caps are on or off, and the current line and column.

The *SPF/PC* disk contains two support files, Spfpc.opt and Spfpc.pro. The first allows you to specify the type of memory that *SPF/PC* is to use, even getting down to the nitty-gritty of requesting use of the extra pages on the color board. This program squeezes out every bit of available memory (up to 786K) and puts it to good use. The second file allows you to specify tab fields, default drive, caps on or off, the maximum record length, and the initial scroll value, all based upon the extension associated with a filename. The program makes full use of the function keys and combinations of control with selected keys. While not a word processor, *SPF/PC* does include functions for entering, pulling together, and printing text. The program can also do wordwrap.

The *SPF/PC* documentation—a slipcover binder filled with a description of the program, hints and tips, a detailed description of each command with examples of before and after operations, a section devoted to error messages, and extensive information concerning the two support files—is clear and concise. The disk comes with an on-screen tutorial and an example with which to experiment. The program works well with RAM disks as well as hard disks and is not copy-protected.

Rogue River Software's policy concerning fixes and new releases is noteworthy. A registered owner of *SPF/PC* can send in a disk and five dollars at any time to receive the current fixes. When a new version becomes available, registered owners can buy it for the difference in price between their current copy and the new release. HG

SPF/PC, by Ken Rodgers, Rogue River Software (2822 Tahitian Avenue, Medford, OR 97504; 503-779-3002). $149.95.

Mailing List Manager

Mailing List Manager, from Peachtree by way of IBM, is a simple file management program whose output component is specialized for the production of mailing labels. The program's command language is modeled after that of the *PeachText* word processor.

MLM allows you to define files with up to fourteen fields. That's more than most people want to put on a mailing label, of course, but those seven or eight fields in excess of the standard addressing data can be used to hold a wealth of information about your addressees—information that can serve as the basis for selective mailing runs.

All fields are alphanumeric, which is to say that *MLM* doesn't do any calculating as such. The fact that even zip fields are treated as sequences of ASCII values rather than as numbers might exact a small price in terms of storage efficiency, but it keeps the file-definition procedure simple. No need to fuss over data types when creating an *MLM* file.

Up to three fields can be designated as key fields; these function as indexes into your mailing list data. When it comes time to review, edit, prune, or add to your list, you can stroll through your file in ascending or descending order according to the values stored in any one of these key fields. You can also specify a value for one of your key fields as a search criterion and call up more or less immediately the record or records that match that criterion. When it's time to do a mail run, you can designate any field as a primary sort criterion (and specify secondary and tertiary sort criteria as well, if you wish), but naming a key field as your sort criterion will get you a quicker sort than naming a nonkey.

Adding, editing, searching for, and deleting data are all done within the same program module. When you want to add names to your list, you start by selecting an index field; typically that will be the name of your addressee. Then you enter a value for that field. *MLM* responds

by trying to find a record in your file matching that value (in other words, it acts at first as though you were trying to perform a search). Finding none, it gives you the option of adding the record and then brings up the blank fields for you to fill in.

The fact that adding data and searching for data are treated by *MLM* as a single process means you have to hit a few extra carriage returns for each record. But it has the advantage of helping you weed out that common mailing list bugaboo, the duplicate entry (if *MLM* does find a record matching the name you want to enter, it displays that record and gives you the option of adding another record under that name or backing out). Unfortunately the program doesn't offer soundex search; it only finds exact matches. So it doesn't do anything to help forestall the almost duplicate entry. Furthermore, if you happen to have more than one entry under a given name, the program won't warn you of an impending duplication of, say, the second or third entry; you probably won't discover those duplications until you print labels.

As you're entering data, you can plug in assumed (default) values for any number of fields. Each time you begin filling out a new record, then, the assumed values will appear in the appropriate places, saving you the trouble of entering recurrent data items. That's a great help for almost any mailing list application, and it's very simple to use; you don't have to go back to any file-definition routine to specify or change these assumed values.

The label-printing procedure consists of three steps: label definition, positioning of data fields on the label, and mailing specification.

The first step is to lay out the physical dimensions of the label, specify the number of labels across that you wish to print (you may print as many as five up), and select a print font. The program, being from IBM, naturally is designed to use the font features of the IBM matrix printer; but it will drive the Epson's as well. You may also use a letter-quality printer with *MLM*, but you won't be able to use your printer's proportional spacing capability.

The second aspect of the printing procedure, the arrangement of fields on the label, is frustrating in only one respect: You cannot truncate fields at this stage of the game. So if your file has a thirty-character address field, your labels must also allow thirty characters for the address—even if you've never used more than twenty characters. (The program does, however, provide ways of modifying file structure, which we'll examine shortly.) Label definition specs—including both the physical components described in the previous paragraph as well as the positioning of data—can be named and saved to disk.

The final step is to define the specifications of the mailing itself. Here you get to name a sort key (zip code, for example), choose between ascending and descending sorts, select output to printer, screen, or disk file—and make a few other decisions as well. One of the ways in which *MLM*'s output routine is specialized for the printing of mailing labels is that it allows you, if you wish, to compress blank lines on the label. So, for example, if your label includes apartment or suite numbers on a separate line, you won't get blank lines on those labels lacking that information. Other options offered are multiple output (more than one label per record) and the reversal of information in a selected field before and after a comma. This last one makes it convenient for you to enter data into the file in the form Johnson, Ray (so you can browse by last name without having to make the last name a separate field), and still get right-reading labels.

The define mailing module also allows you to specify a profile. That is, you can ask to print only those records matching designated criteria. The criteria may include the logical operators *and* and *or*, as well as the relationals *less than*, *equals*, *greater than*, *includes*, and *excludes*. A single-character wildcard, which functions just the ? in DOS, is also available. Parentheses to define logical operator priority are not available as such; rather the program distinguishes between *and* and *or* written in lowercase letters and the same operators written in capitals. The uppercase operators are more inclusive than the lowercase ones. At least one user finds this design approach nonfriendly and confusing.

One more annoyance having to do with printing: The program lacks a pause print feature. You can abort but not pause. Be sure you have enough labels before starting the run.

Here are some observations about performance in *MLM*. When you're entering data, the program goes to disk each time you finish a field. If you're using three index fields, the program has to write information on each record into four files—the main data file and one file for each index. And each time it writes to an index file it has to perform a quick sort of that file. So when you get up to a few hundred names in a file, you're going to find yourself waiting after each record. That is, if you're working on a floppy system. On an XT the delays are negligible.

The remedy, of course, is to keep files small. If you find a file becoming too large, you can copy it, then stroll through each copy and make the appropriate deletions. This copy procedure also bails you out in case you have forgotten to define as many fields as you need, or in case your field lengths are insufficient. You define the field specifications for your target file before you copy data into it, so you can add or lengthen fields at that time. You can also eliminate or shorten fields. Data that doesn't find a home in the target file is simply liquidated (or truncated). The copy routine even allows you to change the field correspondences between source and target files—that is, you can have source field 2 become target field 6, or whatever.

Sorting in *MLM* seems acceptably quick. A five-hundred-record file with primary and secondary sort keys, both indexed, takes about a minute to sort. The same file with only a primary sort key, not indexed, takes about the same time. These times were measured on an XT; figure to wait a good while longer for a file of that size on a floppy (but re-

member, you'll probably want to keep files smaller on a floppy anyway).

The command language of *MLM* is simple and logical; reasonable use is made of the function keys, and cursor movement can be done either by function key or by arrow key. In keeping with IBM's rules for good human interface, *MLM* lets you hit escape to back out gracefully from any program option. On-screen help is provided as well, although it's not context-sensitive (you have to escape to the main menu and hit *??*). The manual is clear, simple, and indexed. CS

MLM is copyable.

Mailing List Manager. IBM (Box 1328, Boca Raton, FL 33432; 303-998-2000). Requires 128K.

Styx

The world is a box where the scintillating Styx whirls and flashes in its many colors. Your job is to capture the Styx by enclosing larger and larger areas of the box. When you have enclosed 80 percent of it, you are victorious. But beware: any contact with the Styx is fatal, and so is the guardian that patrols the rim of the box.

This is a new version of the hoary arcade game *Qix*. It is a smooth-running, colorful implementation. In some respects it is better than the original. You can use keyboard or joystick to move in any of eight directions, and there are three different point values for enclosing areas at the right time. Defeating the Styx wins you a bonus based on the area enclosed, and you proceed to the next level of difficulty, with multiple guardians or multiple Styxes. High scores are automatically saved to disk.

If the original version of this unpretentious little game appealed to you, Styx will too. FJ

Styx, Windmill Software (2209 Leominster Drive, Burlington, Ontario, Canada L7P 3W8; 416-336-3353). Requires color/graphics adapter. $39.95.

Move-it

Move-it is one of the best intercomputer communications packages on the market. The software runs under CP/M for 8080, 8086, and 68000 systems and under MS-DOS as well. *Move-it* allows you to send and receive files from another computer (only one remote computer), list directories of the remote and host computer, send messages, and emulate a dumb terminal. The best thing about the package is that it's available on so many systems. The software works on the IBM pc (in PC-DOS and CP/M-86), Altos, Godbout, DEC Rainbow, Otrona, Digital Microsystems, among others.

One of *Move-it*'s best features is its ability to transfer binary as well as ASCII files. The program uses a blocking technique that allows for transmission of binary data. The program runs at the baud rate of the serial port (usually 9600 baud) and is reasonably fast. The system checks for data transmission errors, communication disconnection, and line time-outs. The program is easy to use (it has a built-in menu system) and requires very little study to learn its operation. The program uses standard CP/M or MS-DOS file and keyboard input conventions. In addition, *Move-it* can be used with modems for long-distance communications. SS

Move-it, by Woolf Software Systems (23842 Archwood Street, Canoga Park, CA 91307, 213-703-8112). $150.

Suspended

The first product of Mike Berlyn at Infocom is exactly what you might expect in your wildest dreams: a highly intelligent, intricately plotted, totally playable, challenging, and satisfying adventure, and, of course, a breakthrough.

Suspended takes place on a computer-controlled planet; the failsafe, in case of computer malfunction, is human—that is the role the player assumes; and, as you begin, the computer has just malfunctioned.

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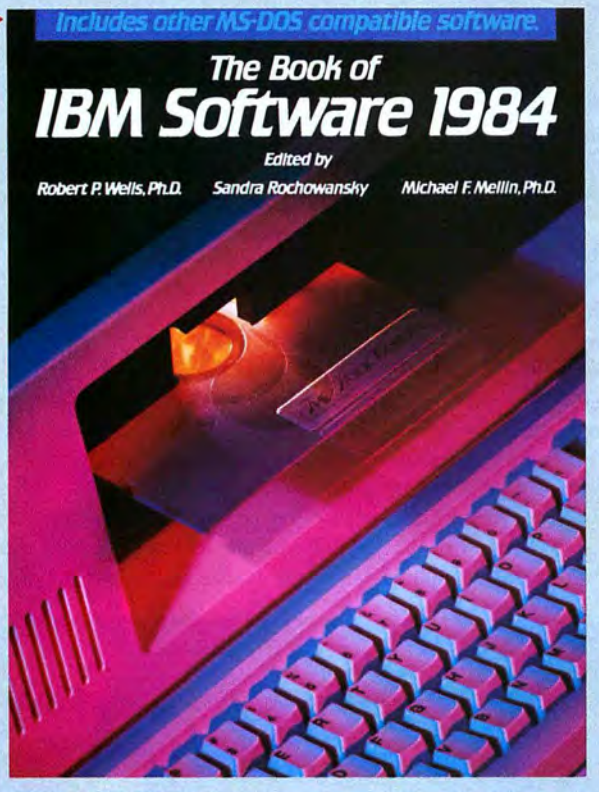

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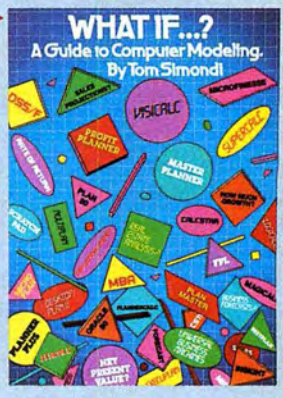

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Awakened just enough from a cryogenic sleep to think clearly, but still in a vulnerably suspended state physically, you must direct the actions of (here's this week's breakthrough) six unique robots to manipulate the controls that maintain the planet manually and to ferret out the causes of the malfunction and correct them.

Each of the six robots is individual, with strengths and weaknesses. Auda can hear; she cannot see. Iris can see, but she is confined to a small section of the control center. Sensa can detect physical waves and emissions, but she cannot manipulate things well. Waldo can manipulate just about anything, but he cannot always figure things out. Whiz is terrific when he's getting information from the central computer, but he's little more than an errand runner away from his plug. And Poet, well, Poet's makers missed the boat in debugging; he does his job well—he understands much through touch—but he speaks in poems and riddles.

There's a good argument that the robots are essentially personifications of human senses; if that fascinates you, consider it now. Once you begin playing *Suspended*, you are apt to be so charmed by the individual personalities of the six robots that you won't want to think of them as symbolic of anything. They are themselves, varied and colorful and friendly.

The robots are independent of each other. You can send several to various places and have others do other things while the first are on their way. In fact, to win the game, you'll have to find efficient ways to keep all the robots working simultaneously. Infocom provides a full-color laminated map with stick-on symbols of the six robots to help you keep track of who's where.

The object of *Suspended* is to repair the malfunctioning parts of the control center with the fewest possible fatalities planetside. At first, it seems impossible to finish the job at all before angry humans from the planet storm the control center to replace you for a job poorly done. But once you've solved all the puzzles, the temptation to go back and do it all more efficiently is strong. Can you do it with no fatalities?

Berlyn has succeeded in devising an adventure that is so absorbing, so compelling in the pleasure of the achieving, that you can replay it again and again.

Recognizing this, Berlyn included three extra modes of play: advanced, configure, and impossible. Advanced starts you off later in the game with one robot out of commission. Configure lets you choose your own parameters—how many robots are functional, how soon angry humans come in from the planet. Impossible—well, impossible's a joke.

As usual with Infocom games, the vocabulary is even more extensive than the last Infocom game. If you are using your mind, *Suspended* will probably understand you. If there's an approximate common word for a concept and a precise uncommon word, try the precise one.

Suspended is an intelligent, logical, well-plotted, compelling and absorbing, challenging and satisfying text adventure that begs to be played over and over again.

What more can an intelligent adventurer ask? Graphics?

Bite your tongue. MCT/MF

Suspended, by Michael Berlyn, Infocom (55 Wheeler Street, Cambridge, MA 02138; 617-492-1031). $49.95.

The Author

The Author is a tool that enables course designers (authors) to develop lessons that can then be run by users (learners). A lesson package may contain up to six lessons. Each lesson consists of a set of frames, each of which typically contains one screen of data. Frames are available in three types: instructional (containing narrative text for the user to read), lesson menu (allowing the user to select the next lesson), and question frames.

Frames created by *The Author* are numbered and chained together so that paths are defined for both correct and incorrect answers. With proper frame design and linking, reinforcement and assistance for the student can be automatically provided as necessary.

Four question types are available. Multiple-choice questions permit up to six possible answer choices. True/false questions allow an answer of true or false. Sequencing questions are really just another form of multiple choice. Fill-in-the-blank questions require the user to select and type in one of six possible answers. This is purely an exercise in reading and copying, not learning, and like sequencing, it is a variation of the multiple-choice type.

Once an author has developed a lesson, the user can begin to run that lesson. After all the questions in a lesson have been answered, the user can elect to review selected topics. The user can choose to record statistics (learner records) throughout the session. These records can be reviewed only by the author. The statistics option tracks scores, averages, totals, and percentages for up to sixty users per lesson.

The system includes a comprehensive tutorial lesson package on the use of *The Author* itself, as well as detailed instructions on how to create a test lesson on accounting principles.

The distribution kit contains three single-sided disks and a user manual. There are two copies of the write-protected master disk. This disk contains all the interpreted Basic source code and some fictitious learner records that are used to demonstrate the statistics options. The third disk contains the demonstration lesson package. All Basic source code files are stored in protected mode.

The documentation is specifically aimed at the author. It consists of more than two hundred 8½-by-11-inch pages. The black vinyl three-ring binder has a useful pocket inside the front cover in which you'll find two forms used in course design, a menu/question frame sheet, and an instructional lesson sheet. These forms are invaluable for proper course design, and they are well laid out. Examples of their proper use abound throughout the manual. The manual content is basically sound

but could benefit from cosmetic surgery in the table of contents, page number positioning and chapter headings. Alas, there is no cross-reference index.

The Author requires an IBM pc or compatible with at least 64K and one or two single- or double-sided disk drives. A second drive is necessary if user performance statistics are required. Single- and double-sided disks may contain up to 76 and 152 lesson frames respectively. A serial or parallel printer is supported but not necessary. PC-DOS (1.0, 1.1, or 2.0) and Basic are also required. The lesson-generation program won't run on a 2.0 system with only 64K, but then neither will most other vendor programs.

The programs require an eighty-character screen width; if a forty-character screen is used, the text just wraps around. Unfortunately, no use is made of color. It would seem that instructional material could be made more interesting if color were used. The same comment applies to nonuse of IBM's extended ASCII graphics characters.

The current version of *The Author* was released prior to the announcement of PC-DOS 2.0. Unfortunately the lesson author has no choice for the lesson disk file names. Each lesson is given the same name. This limits lessons to one per disk for PC-DOS 1.n and one per directory for 2.0. This artificially created limit is not a great problem, since many lessons will likely fill a disk anyway; some disk space, however, will undoubtedly be wasted, and the directory contents give no indication of which lesson the disk contains. Users with multiple-directory floppies or hard disks would have to set their default directories at the DOS level, run a lesson, and then, if they wanted to run another lesson, exit to DOS, switch directories, and start again.

According to the vendor, this situation, along with several other problems and restrictions, will be rectified in the next product release. This release will (mysteriously) be version 6.0 and will be a separate product. It will include color, graphics, and DOS 2.0 support and should be available before the end of this year.

The author and user programs involve a lot of menus. Most questions require a one-character reply and are easy to use. Little use is made of the ten function keys, a deficiency that should be remedied in the next release. Error messages are meaningful and plentiful.

Creating user disks is a little messy, since the user has to invoke Basic with several parameters. It could be made much simpler and would in fact be done differently by an enterprising author. There is room for both DOS and Basic on the master disk, and with the help of Autoexec or other batch-procedure files this process could and should be made more transparent to the end user.

Telephone support is available directly from the vendor during normal business hours. More than a hundred copies of the product have been installed in pcs in educational institutions, corporations, systems houses, and government agencies. More copies have been sold to generic MS-DOS users. *The Author* is the first software product for the five-year-old consulting/software vendor. Several staff members joined the company from Control Data Systems and have experience with CDC's Plato educational system.

The Author appears to be a flexible and powerful educational tool. With the improvements slated for the next release, its utility and ease of use should be significantly increased. One caution: *The Author* will not generate a course for you. It will, however, enable you, the course designer, to define lessons and their interrelations.

Happy learning. RJ

The Author, version 2.0., Phoenix Performance Systems (324 South Main Street, Stillwater, MN 55082; 612-430-2980). $195.

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Demon's Forge

The king's infamous dungeon maze, the Demon's Forge, is open for adventurers, but it seems the king was not pleased when someone got drunk and killed four of his guards. Ancient rumor hints at an exit from this evil place, but no one in living memory has discovered it. Most of those unfortunate enough to be cast down here become a snack for the keeper of the dungeon, the demon Anarakull.

Clothes and weapons are not part of your dungeon tour package. The king was gracious enough to allow a small packet of rations. The first level of the dungeon seems deceptively easy. You only need to watch out where you put your hands!

The entire maze is diabolically laid out in modules. When you finally solve the entrance to the next module and exit the old one, you find that it's a one-way trip. If you haven't brought along all the correct items, there's no way back to get them. Luckily the game has a built-in multiple game save feature. The cautious adventurer always saves a game before venturing into the next module.

Most items in this dungeon either are not what they seem or have extraordinary characteristics. Beware of the killer rabbits on loan from *Monty Python and the Holy Grail.* Illusion reigns supreme and everything should be examined, pushed, or prodded. But be careful!

The hi-res graphics are good and some of the effects are quite interesting. The parser, however, is not very forgiving. The player must use the exact word or phrase to achieve a desired effect. In some cases the phrase required seems needlessly obscure.

Demon's Forge is a good first effort by a new software house. It is highly recommended to the intermediate level adventurer. Persistent novices may also be able to complete the hazardous journey. RRA

Demon's Forge, by Brian Fargo, Saber Software (8 Winged Foot Lane, Newport Beach, CA 92660; 714-644-0977). $39.95.

Buzzard Bait

Be unkind to your fine feathered friends, or you could end up somebody's breakfast.

The California Condors are nesting and are turning humans into an endangered species by snatching them to feed their chicks. Swoop, grab, and the kid in tennis shoes goes down the hatch. The chick withdraws with a contented expression, to reappear as a vicious fledgling.

To combat this avian menace, you have three ships, which appear one at a time at the bottom of your screen. They move and fire much like the ones in *Space Invaders.* But there's a twist. A dangerous penguin occasionally flies across the bottom of the screen, and you can activate your jets to jump over it. At the higher levels of difficulty, the buzzards not only swoop down at you, they also drop unmentionable substances. With a maximum of six buzzards on the screen, this makes for a messy battlefield.

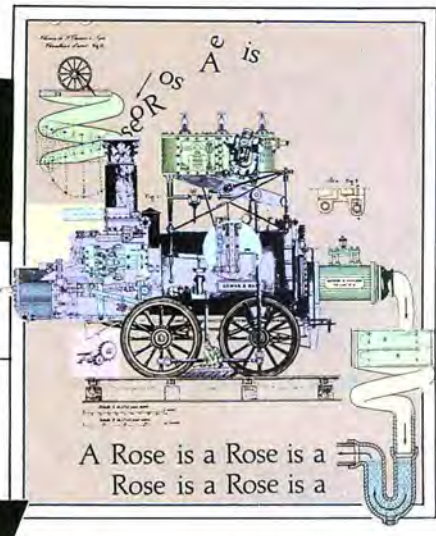
You get an extra ship for every five thousand points. In addition, there is a bonus ship round. This phase is a study in Brownian motion. You are bouncing around in space trying to retrieve ship parts from a cloud of bothersome penguins. To complicate things, there is a mine layer who runs around making life dangerous for you.

This game can be used with keyboard, paddles, or joystick. Most players will prefer the joystick. The animation is very smooth; the buzzards glide back and forth with uncanny deftness. The detail is very sharp. The only problem is minor: The program ignores a fire command if there are already two missiles on the screen. This means your guns can jam at a very inconvenient moment.

An excellent shoot-'em-up for arcaders and friends of J. Watt. FJ

Buzzard Bait, by Mike Ryeburn, Sirius Software (10364 Rockingham Drive, Sacramento, CA 95827; 916-366-1195). Requires color/graphics adapter. $34.95. ▲

THE PROCESSED WORD



by Terry Tinsley Datz and F. Lloyd Datz

VisiWord and VisiSpell

When the company that gave us electronic spreadsheets introduces a word processor, that word processor is guaranteed to attract attention. After all, *VisiCalc* has practically become a household word. But just as *VisiCalc* is now threatened by competing programs, such as *1-2-3* and *Multiplan*, VisiCorp's new word processor will also face some stiff competition. This month we'll look at *VisiWord* and its companion, *VisiSpell*, to see how they measure up against the growing crowd of word processors for the pc.

VisiWord

Like other products in the VisiCorp family, *VisiWord* is aimed squarely at the business user. It is, in fact, designed specifically for the businessperson who does word processing only occasionally. As a result, *VisiWord* is so simple to use that you'll rarely need to consult the manual. On the other hand, the extensive menu system and the maze of safety features—so comforting to the new or occasional user—can turn into an obstacle course for those who do word processing on a full-time basis.

Overall Design. If you're a *VisiCalc* pro, you'll be right at home with *VisiWord*. Both programs use a similar network of menus and submenus. In fact, some of the commands are even the same; for instance, the *VisiWord* command to load a document for editing is the same as *VisiCalc*'s command to load a worksheet.

In both programs, you can enter commands by typing the first letter of the desired menu option. *VisiWord*, however, gives you the alternative of positioning a menu cursor over the option that you want and pressing return to enter your command. The advantage of the latter technique is that it gives you a short description of each menu item as you move the cursor over it.

The special function keys control editor and formatter functions, such as deleting, undeleting, centering, and underlining. Especially handy is the F2 key, which allows you to repeat the most recently entered command without retyping it.

Text Entry and Editing. The layout of the editing screen is elaborate. An inverse-video border surrounds the text entry area; within this border, information about the document being edited is displayed. Although the inverse-video effect is eye-catching, it has one drawback: After many months of word processing, you may find that the border has been permanently etched into your screen.

A ruler at the top edge of the border indicates tab stops and marks the cursor's horizontal position. The side border is used for special symbols, such as hard carriage returns; the bottom border displays help messages and serves as a status line for information about the command in progress and the line number of the cursor. At the bottom of the screen, a menu lists the available options. Oddly enough, status information on page and column numbers isn't provided; this omission makes it difficult for you to keep up with your exact whereabouts in a document.

The arrow keys move the cursor a character or line at a time; for longer moves the home and end keys are used. Pressing the home key once moves the cursor to the beginning of the line; second and third presses take you to the top of the screen and to the beginning of the document respectively. The end key works similarly but in the opposite direction. Jumps to a specific page or a marker aren't possible; you have to scroll the text continuously (a slow procedure) or use the search feature.

When you begin editing, you're automatically in insert mode. As you enter words, the text in front of the cursor is pushed forward rather than being split at the point of insertion. To correct typos, you can switch to overtype mode by pressing the insert key. The status line keeps you informed about which mode you're in.

Deletion commands are logical: The delete key erases the character under the cursor, and the backspace key deletes the character to the cursor's left; the F5 and F6 keys delete whole and partial lines respectively. For larger deletions, you position the cursor over the first character you want to erase and choose the *deletion* option from the main menu. From a submenu you then select either *text* or *column* and proceed to mark the segment by moving the cursor forward. If you accidentally overshoot the end of the segment you want to delete, you're out of luck. Since you can't back the cursor up, you have to start the process again.

To a limited extent, accidental deletions can be recovered by use of the undelete command. This applies only to single lines, however; any other material (blocks of text, for example) is lost forever.

Cut and paste functions are limited in that sentences can't be split, and moves can be made only to portions of text that follow a carriage return. The technique for these operations is similar to deleting except that you choose *move* or *copy* from the main menu.

Not surprisingly, *VisiWord* makes it easy for you to manipulate tabular material—such as spreadsheets—within your documents. Using column mode, you can edit, copy, and move individual columns of numbers (or columns of text, for that matter) without disturbing their format. To align a column of numbers automatically by decimal point, you simply press F1 before you type each number. Even the extra width of spreadsheets isn't a problem: Horizontal scrolling allows display of up to 255 columns. VisiCorp purposefully did not include a math mode, assuming that you'll use *VisiCalc* for your math operations.

VisiWord is capable of windowing, a rare feature among word processors. By dividing the screen in two, you can readily copy or move text from one part of a document to another or transfer it between two different documents. The screen doesn't have to be split precisely in half but can be divided at any point, provided that there are at least three lines in the smaller window. As you switch the cursor between windows to enter or edit text, the inverse-video border moves simultaneously to indicate the active window.

Formatting and Printing. With a few exceptions, *VisiWord* shows your text on-screen just as it will be printed. These exceptions include

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line spacing (only single spacing is shown) and special printing features, such as boldface, underscore, overstrike, superscripts, and subscripts. Since inverse video is used indiscriminately to indicate all special printing features on-screen, the only way to tell which feature is in effect is by the abbreviation displayed on the status line.

A welcome surprise is automatic paragraph reform. As you make deletions and insertions, the surrounding text is reformed in accordance with the format settings you've chosen. You'll especially appreciate this feature should you decide to change a document's format, say, from single to double spacing. The text will be automatically realigned, saving you the trouble of backtracking to reform each paragraph manually.

If you want to insert hyphens (a virtual necessity if you're using right justification), you're on your own. Since no hyphen-help feature is offered, you have to anticipate words that need to be divided and insert ghost hyphens appropriately.

Default values for margins, line spacing, justification, and tab stops can be permanently changed. This feature can be a real timesaver if you consistently use one specific format, since it allows you to avoid changing the settings each time you use the program. You can also set up different document templates, save them on disk, and call them as needed. For example, separate templates can be defined for letters, memos, outlines, or any other form you commonly use. This is a powerful and convenient option that must be used to be fully appreciated.

To change format *within* a document, you place the cursor in the text where you want the new settings to take effect and then call a menu that lists the current settings. By altering these values, you can reformat all the text that follows.

You define headers, footers, and page numbers in a similar manner, by making entries in a layout menu. Headers and footers can be up to three lines long and can be positioned at the left or right margin or at the center of the line. Unless you specify otherwise, page numbers won't be printed. Automatic footnoting isn't supported.

Although the special printing features are simple to learn, they require an incredible number of keystrokes. As an example, to print text in boldface, you first press escape to call up the main menu; then you select *layout*; from the layout menu, you choose *char*. Finally, from the character menu, you select *emphasis* and press the F2 key for each character you want to appear in boldface. Fortunately, special provision has been made for underlining—only the F8 key need be pressed.

File Handling. Although *VisiWord* doesn't automatically back up your files, it does display messages reminding you to save your file to disk. As a result, it's next to impossible to get out of the program without saving your work.

There are several convenient file-handling features. Without having to exit to the operating system, you can delete files or format a new disk. Especially handy is the document statistics screen, which shows you the number of words in the document, the number of words both above and below the cursor, and the percentage of memory used. Students, writers, or anyone else who has to keep a tally of the number of words written will find this feature indispensable.

Since automatic disk buffering isn't done, the length of document that can be edited in one piece is limited by your system's memory. With 128K (the minimum memory requirement), the limit is eight to ten pages; with 192K, it's approximately forty double-spaced pages. When the document you're editing approaches these limits, you get a preliminary warning politely suggesting that you save the document; if you continue editing, you'll soon get a final notice insisting that you save your work.

You can create longer documents by appending several files together, although the

procedure is roundabout. When your document reaches the size limit, you name a file to be attached; you then save the original document, select the *append* option, and continue entering text—this time in the new file. Files chained together in this manner can be printed as one document. At print time, as each file is printed, you'll be asked whether you want to print the next.

One of *VisiWord*'s strengths is that it works with files from other Visi-series software, specifically *VisiCalc*, *VisiFile*, and *VisiSpell*. In fact, the manual gives you instructions for inserting spreadsheets into your document and for merging data from *VisiFile* into form letters.

VisiWord gives you good control over the printing process: It will print a partial document, pause for a paper or print-wheel change, and print directly from memory without requiring you first to save your document to disk. Using the spooling feature, you can print one document while editing another, provided that you have a system with two disk drives. Since the program considers printing to be secondary to editing, you'll notice that your printer stops and starts intermittently during this process.

Ease of Learning and Use. VisiCorp has unquestionably succeeded in making *VisiWord* simple to learn. With all the help offered, you'll find it difficult to get into a bad situation when you're first using the program. The on-screen explanations of menu options guide you through the program and spare you the burden of constant reference to the manual. Also helpful are the warning messages that appear in almost every situation where you're likely to go astray. For example, if you attempt to save a document under a previously used file name, the program verifies that you want to use that name before it destroys your original file. The menu options are even presented with the cursor on the safer choice (in this case—no, do not destroy the original file) so that you won't accidentally press the enter key and select the wrong alternative.

If you do become confused about what to do next, you can get on-screen help at any point in the program. Help messages automatically appear on the program's start-up screen and (as already mentioned) in the line above the menu. You can also call up separate screens that give instructions for specific tasks. For instance, there is a different help screen for each menu; from each of these screens you can request additional information, such as descriptions of what each special function key does.

The same features that prevent accidents and make *VisiWord* so quick to learn also make it somewhat slow and clumsy further down the road. As you saw in the boldfacing procedure described earlier, some functions can be agonizingly slow. The process of confirming entries in error-prone situations also slows the program's pace. Making things worse, the cursor is lethargic—it often hesitates momentarily before responding to editing commands. In particular, when you're deleting a string of characters one at a time, the cursor sometimes stops and starts sporadically. This problem doesn't affect text entry, however; the keyboard buffer can keep up with your fastest typing.

Documentation and Support. VisiCorp's documentation is very professional. A twenty-three-page tutorial, which takes about a half hour to complete, introduces you to the basic editing, formatting, and printing commands. The 216-page user manual, although guaranteed to cure your insomnia with its dry writing style, covers the program thoroughly. Using sample screens to illustrate, it gives you step-by-step instructions for every feature offered. Also included are a combination index and glossary and an appendix of error messages; the appendix tells you where you went wrong and (more important) how you can recover. A quick reference card and a keyboard overlay for the special function keys are also provided.

VisiWord is copy-protected; backup copies aren't automatically provided but can be purchased for $20 apiece. Although the manual suggests you contact your dealer with any questions or problems, it also provides a hotline number in case you want to deal directly with VisiCorp. Their phone support has been excellent in the past.

VisiOn. According to VisiCorp, the *VisiOn* package will include a modified version of *VisiWord* (called *VisiOn Word*), plus two other programs—*VisiOn Calc* and *VisiOn Graph*. This integrated package will be controlled by a mouse and will give the pc multitasking capabilities.

Audience. Since it's very user-friendly and can be relearned quickly, *VisiWord* is a good choice if you do word processing infrequently or on a part-time basis. If, in addition, you're already using one of the other Visi products, it's probably ideal. For creating long documents or for full-time word processing, however, you might be happier with another program.

VisiSpell

VisiSpell was designed as an integrated spelling checker for *VisiWord*, but it will work on any standard DOS ASCII file; it works fine, for example, on files created with *WordStar*.

The program uses two dictionaries, a personal dictionary of fifteen thousand commonly used words and a main dictionary with a phenomenal one hundred thousand words. To speed proofing, the personal dictionary is loaded into RAM along with the spelling program so that the majority of words in a document can be matched quickly. Only when it encounters a word that isn't in the smaller dictionary does the program go to disk to check the main dictionary.

From within *VisiWord* you can call the spelling checker by selecting the *VisiSpell* option. If you're using floppy disks, you must at that point remove the *VisiWord* disk and replace it with *VisiSpell*; after the program is loaded into RAM, you have to make a second disk change, this time to insert the dictionary disk. (If you have a hard disk, no disk swapping is required.) To save you the trouble of typing file names, the last document saved under *VisiWord* is proofed automatically, unless you specify differently.

Just like *VisiWord*, *VisiSpell* is based on a series of menus. From the main menu you can proof the document last edited, proof a different document, change the default settings, modify the dictionary, or delete a file.

Unlike many other spelling checkers, *VisiSpell* shows you each misspelled word in context; twelve lines of text are displayed, with the mismatched word indicated by inverse video. The program then suggests an alternate spelling, which it has selected from its dictionary. If no alternate spellings are found, *VisiSpell* displays a series of asterisks instead.

To decide which alternate word to suggest, *VisiSpell* attempts to analyze your particular spelling and typing mistakes. For example, if you tend to transpose letters ("recieve" instead

of "receive") or to type run-on words ("youcan" instead of "you can"), the program takes note of this pattern to select more appropriate alternates. It remembers this information, however, only until the end of the current proofing session.

After viewing the mismatched word and its alternate, you have several options. You may:

1. Accept the original spelling as correct. This option leads you to a submenu, from which you indicate whether the spelling is correct for this occurrence only or for all occurrences in the document; you also tell *VisiSpell* here whether the word should be added to your personal dictionary.

2. Accept the alternate spelling as correct.

3. Type in the correct spelling for this or all occurrences, optionally adding the word to the dictionary.

4. Mark the word for later editing with *VisiWord*.

5. Edit the document (you can make changes only in on-screen text).

If the alternate spelling isn't of the word you intended, you can ask the program to display, in turn, all possible matches from the personal dictionary. If you still don't find the correct spelling, you can type the word spelled to the best of your knowledge, supplying the letters you do know and inserting symbols for those of which you're unsure. The symbol that you choose for the unknown letters gives the program clues for finding the correct spelling. For example, if you enter "pers?n?l," the program substitutes all possible letter combinations in the unknown spaces until it finds a match from the dictionary. If you use periods instead of question marks, the program checks to see whether any of the previous letters should be doubled. If you type "oc.ur.ence," *VisiSpell* suggests "occurrence." This searching process is amazing to watch; as different letter combinations are tried out, the letters spin by on the screen like numbers in a tiny odometer.

New words can be added only to the personal dictionary, and each added word replaces one of that dictionary's fifteen thousand words. The replaced words aren't lost from the program, however, because they're all duplicated in the main dictionary.

In addition to finding misspelled words, *VisiSpell* spots hyphenation errors by consulting its list of correctly hyphenated words. It also finds several kinds of common mistakes usually detected only by grammar checkers. To help you detect doubled words (which seem to be an inevitable by-product of word processing) *VisiSpell* highlights the second occurrence of the word so that you can delete it with a single keystroke. The program also detects capitalization errors, such as mixed case (as in "toDay"), and even one error that's specific to the pc: the accidental backslash; *VisiSpell* will flag any word that begins with a reverse slash.

Often in the process of spell-checking a document, you'll discover text that needs minor editing. *VisiSpell* pauses after you correct each misspelling to let you enter a special editor and take care of simple changes. When you reenter *VisiWord* to print the document, you can reform the text if significant changes have been made.

VisiSpell allows you to modify the way it checks your document. By changing the default options to turn off special features that you don't need, you can decrease proofing time. For example, you can tell the program not to pause for editing after you correct each misspelling or you can ask it not to look for doubled words or mixed-capitalization errors. These changes can be used only for the current proofing session or stored on disk for permanent use.

Documentation and Support. Like *VisiWord*, *VisiSpell* comes with a thorough user manual and a short tutorial. With the help of a sample document on disk, the tutorial guides you through a typical proofing session. The examples are explained well and represent most of the options that are possible with the program. After completing the tutorial, you'll be ready to start spell-checking your own documents, consulting the manual only as needed for a reference.

Summary. Without a doubt, *VisiSpell* qualifies as the most powerful spelling checker we've encountered so far. In reality, it's a more impressive program than the word processor it was designed to function with.

System Requirements

For use with DOS 1.1, *VisiWord* requires 128K of RAM; with DOS 2.0, 192K is the minimum requirement. *VisiSpell* requires 128K and two disk drives. Both programs work with either a monochrome or color monitor. *VisiWord* comes with default settings for the IBM 80 CPS Matrix Printer; other printers that can be selected from a printer table are Diablo 630; Epson MX/FX-80 or MX-100; IBM 80 CPS Matrix Graphics Printer; NEC Spinwriter (3550, 7710, 7730); NEC PC-8023A-C; Brother HR-1; Okidata Microline (82A, 83A, 84); Qume Sprint (9 or 11 Plus). VisiCorp has successfully tested both programs with the Compaq; versions for the TI Professional Computer should be available by the time you read this.

VisiWord (Version 1.1) $375
VisiSpell (Version 1.0) 225

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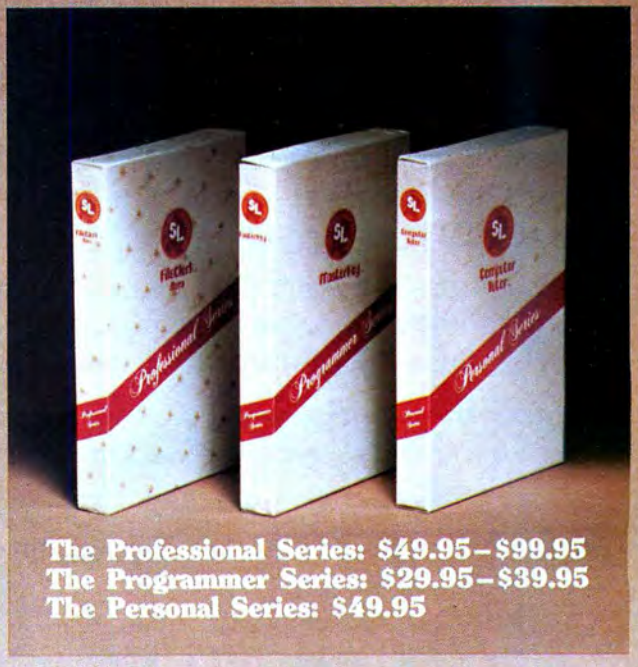

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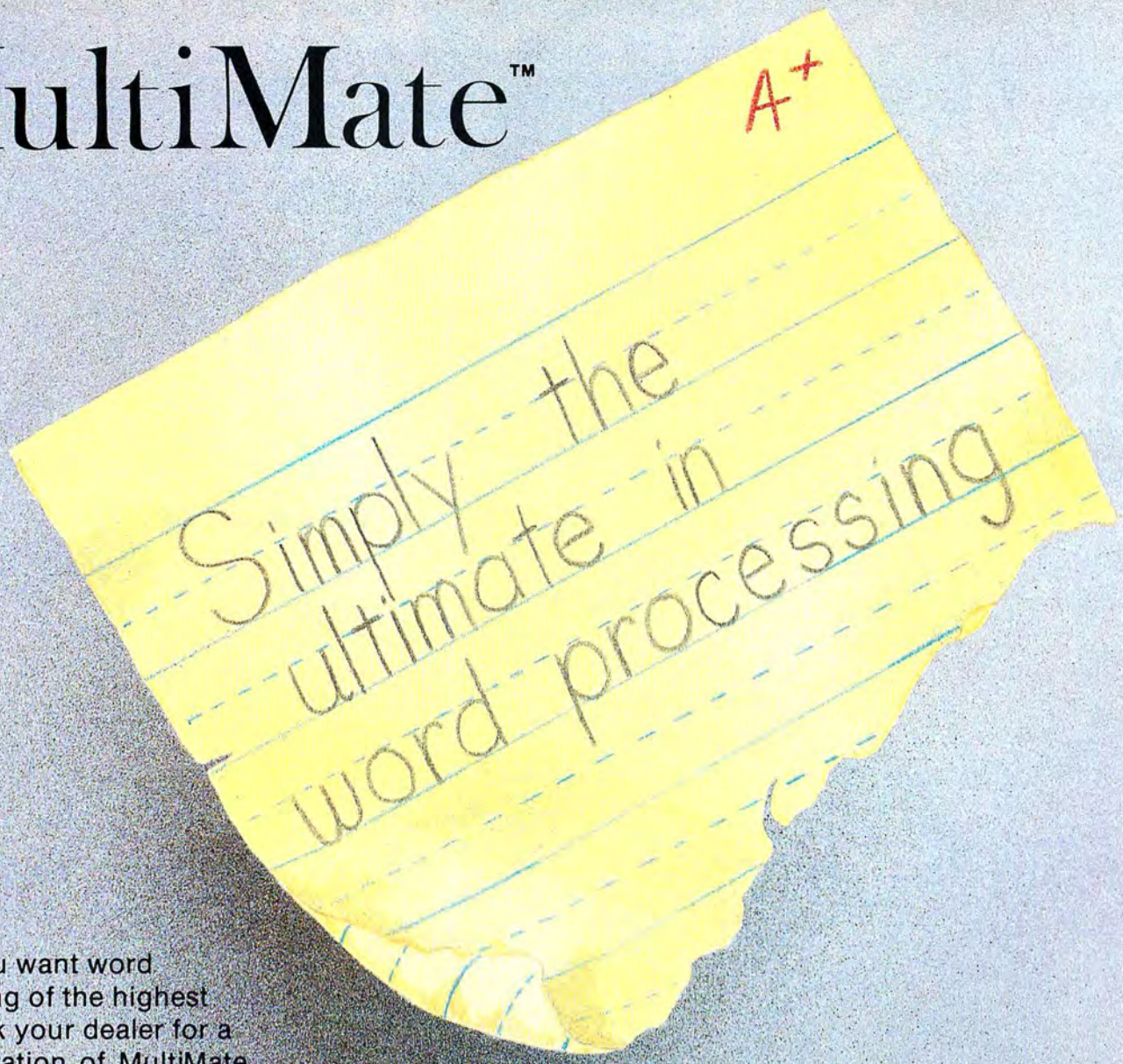

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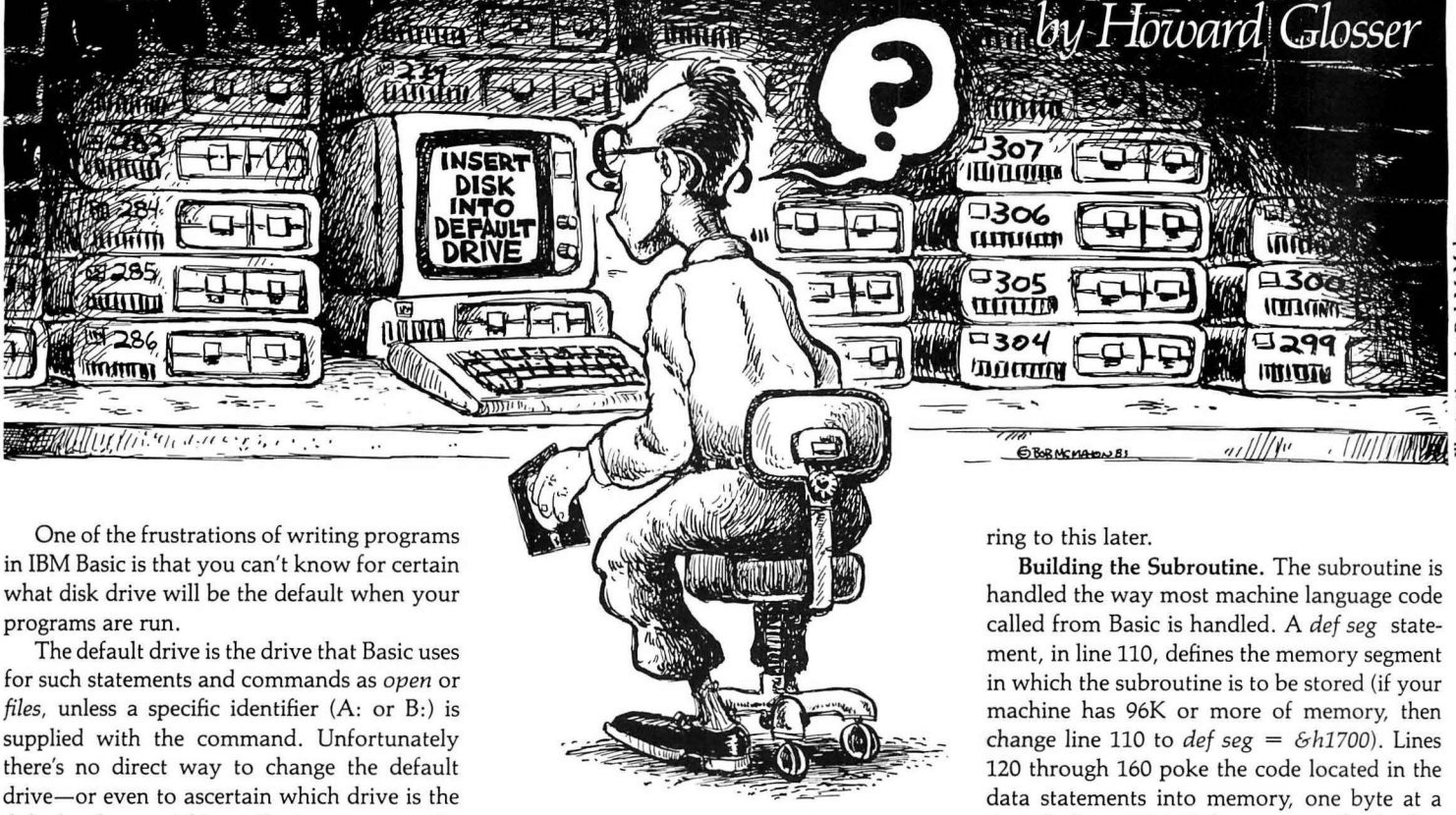
DISK HANDLER

Changing the DEFAULT from within BASIC

by Howard Glosser



Illustrations by Bob McMahon

One of the frustrations of writing programs in IBM Basic is that you can't know for certain what disk drive will be the default when your programs are run.

The default drive is the drive that Basic uses for such statements and commands as *open* or *files*, unless a specific identifier (A: or B:) is supplied with the command. Unfortunately there's no direct way to change the default drive—or even to ascertain which drive is the default—from within a Basic program. So your programs are forced to accept the default supplied them from DOS; that is, whatever was the default at the time when Basic or BasicA was loaded is also the default for your Basic program.

When you're using your own program on your own machine you don't need to be concerned about these inconveniences. You know which is the default drive and can make sure when you load Basic that the correct drive for your program is set. However, when writing a program to be used by another person, whether it's for a friend or whether it's to be distributed in the software market, the story is different. It then becomes important to be able to find or set the default drive.

For example, suppose you need to have an error message displayed. Which of these messages would you prefer that your user see?

Insert the disk in the default drive

or

Insert the disk in drive B:

The first message, the one that Basic provides, could easily leave users scratching their heads in bewilderment, wondering, "What in the world is a default drive?" while the second message clearly and concisely states what action should be taken.

What's a programmer to do?

A Meaningful Interruption. DOS allows you to accomplish all kinds of keyboard handling, video, and disk interaction by means of interrupts and function calls (see Appendix D in the DOS manual). And fortunately, by using *poke* statements to create machine language subroutines, you can access these interrupts and function calls from Basic.

This approach is the basis of the program Disk Handler, presented in this article. Disk Handler allows a Basic program to check for the current default drive or assign any drive in the system to be the default—while the Basic program is running. Disk Handler is simple but has powerful results.

Figure 1 shows the program that builds the disk-handling subroutine. This program was designed to run on a 64K machine. If you have 96K or more of memory, you should make the changes to the Basic program as outlined in the article to load the subroutine into higher memory. This will keep the Basic work area free for your program.

Before you load Basic (or BasicA) and type in this program, be sure to notice which drive is your system's current default. We'll be referring to this later.

Building the Subroutine. The subroutine is handled the way most machine language code called from Basic is handled. A *def seg* statement, in line 110, defines the memory segment in which the subroutine is to be stored (if your machine has 96K or more of memory, then change line 110 to *def seg = &h1700*). Lines 120 through 160 poke the code located in the data statements into memory, one byte at a time. In lines 170-190 the program checks that all the data statements are correct; should an error be found, the message, "Error in data statements—Check lines 290-370" will appear on the screen and the program will end. If everything checks out okay, line 230 saves the subroutine on disk under the name Diskhndl. Any Basic program can then issue a *bload* statement to load the subroutine.

Once you've entered the code shown in figure 1, the hard part is finished; now comes the fun.

Calling Disk Handler. A program demonstrating Disk Handler is shown in figure 2. To use the subroutine you have to set the *def seg* statement once again to the segment address where the subroutine is to be loaded. Line 70 loads the subroutine from disk. In line 80 the variable Disk is set to 0 (this will tell the *call* statement to start at the very beginning of the segment). Lines 50 through 80 are run only once in any program; after the subroutine has been loaded from disk, it can be called as often as necessary (just make sure that the *def seg* statement points to your subroutine before doing the call).

Another variable that must be set is Diskopt%. Since we can do either a find or a set, these options are respectively defined as 1 or 2. If Disk-

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opt% is set to 1, then the subroutine will return the current default drive letter (A, B, C, and so on) in string constant Diskparm$. If Diskopt% is set to 2, then the subroutine will set the default drive to the letter specified in Diskparm$. In the second case, Diskparm$ must contain a valid letter designating the new default drive before you call the subroutine.

To simplify things as much as possible, the functions *find* and *set* have been defined as constants in line 140. The variable Find% is set to 1, and the variable Set% is set to 2. Diskparm$ is defined as a one-character string filled with a space. All this makes the call to the subroutine as straightforward as possible. In summary, Diskopt% is used to tell the subroutine what function should be done and Diskparm$ is used to pass the drive letter to or from the subroutine.

An example of finding the default drive is shown in lines 120-200. Diskopt% is first set to Find% in line 160, and then the call is done. The default drive is returned in Diskparm$ and is displayed on the screen in line 190. Next, lines 210 through 290 set the default by first asking you for the drive letter of the new default desired. The key-in routine in lines 450 through 580 accepts your response. Since the function call used by the subroutine can't handle a lowercase drive letter, line 520 checks your input; if it finds a lowercase letter, then line 560 converts that to uppercase.

Now when Disk Handler is called, the Diskopt% function becomes Set%, and Diskparm$ contains the letter for the drive that's to be the new default. Line 280 calls the subroutine again, and if the drive letter you specified is valid for your system (and different from the current default), the change in default is confirmed by the message in line 420. Otherwise, the default remains unchanged and the message on line 400 is displayed. Which message the program uses is determined by a simple compare in line 380. Back in line 180, the value of Diskparm$ was saved in the variable Savdrv$. This value is compared to the value returned in Diskparm$ after the call in line 370. If the values match, then the default drive obviously is not changed. This condition can occur in two ways: either you specify the same drive letter as the existing default or you specify a drive letter that's not valid for your system. If you do the latter, the Disk Handler subroutine simply ignores your input and returns with the default unchanged.

If the default indeed has changed, you can verify the change by exiting from Basic and looking at the DOS prompt. If the prompt was A) when you loaded Basic (remember?), it should now be B) (or whatever other value you've specified).

For those interested in the actual workings of the subroutine, figure 3 shows the commented assembly code. Hang on as we take a brief look at how Disk Handler works.

```
10 '  ***** DISK HANDLER *****
20 '
30 ' FIND or SET the default drive in a BASIC program
40 '
50 ' Written by Howard Glosser
60 ' DEF SEG=&HF00 ' Use def seg = &H1700 for machines with 96K or more
70 '
80 ' THIS BUILDS AND CHECKS THE SUBROUTINE
90 '
100 CLS
110 DEF SEG = &HF00 ' Use def seg = &H1700 for machines with 96K or more
120 FOR MEM% = 0 TO 66
130  READ DT%
140  POKE MEM%,DT%
150  CHECKSUM%=CHECKSUM% + DT%
160 NEXT
170 READ DT%
180 IF CHECKSUM% = DT% THEN 230
190 PRINT "ERROR in DATA STATEMENTS—Check lines 290-370":END
200 '
210 '  ***** THIS SAVES THE SUBROUTINE
220 '
230 BSAVE "DISKHNDL",0,&H43
240 PRINT "DISK HANDLER SUBROUTINE CREATED"
250 END
260 '
270 '  ***** DATA STATEMENTS TO BUILD SUBROUTINE
280 '
290 DATA &H55,&H8B,&HEC,&H8B,&H76,&H08,&H8B,&H14
300 DATA &H83,&HFA,&H01,&H74,&H08,&H83,&HFA,&H02
310 DATA &H74,&H10,&H90,&HEB,&H2A,&H90,&HB4,&H19
320 DATA &HCD,&H21,&HFE,&HC0,&H32,&HE4,&H0C,&H40
330 DATA &HEB,&H15,&H90,&H8B,&H76,&H06,&H8B,&H7C
340 DATA &H01,&H8B,&H15,&H80,&HF2,&H40,&HFE,&HCA
350 DATA &HB4,&H0E,&HCD,&H21,&HEB,&H09,&H90,&H8B
360 DATA &H7E,&H06,&H8B,&H75,&H01,&H88,&H04,&H5D
370 DATA &HCA,&H04,&H00,&H1D35
```

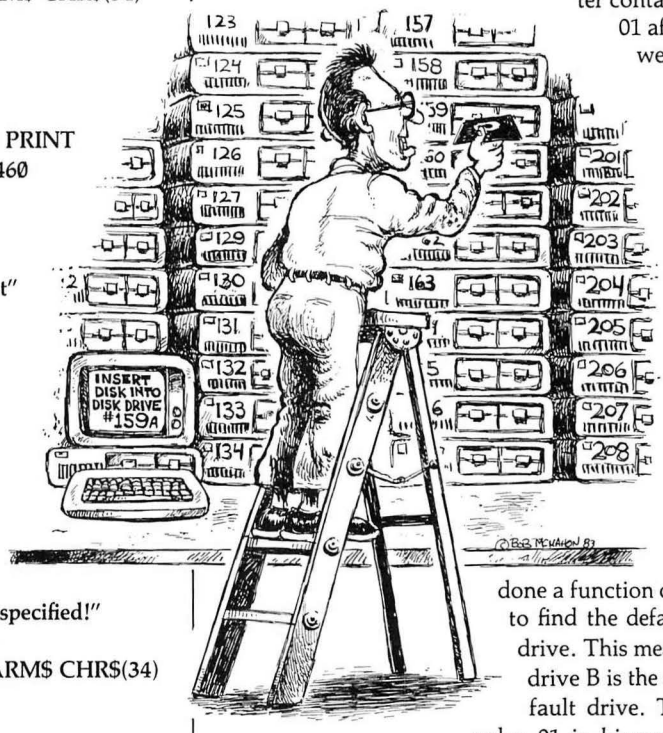
Figure 1

```
10 ' ***** THIS PROGRAM DEMONSTRATES DISK HANDLER *****
20 '
30 '
40 ' **** DEFINE SEGMENT AND LOAD DISK HANDLER ***
50 CLEAR ,32768 ' This line is necessary only for 64K machines
60 DEF SEG = &HF00 ' Use def seg = &h1700 for machines with 96K or more
70 BLOAD "DISKHNDL",0
80 DISK=0
90 CLS
100 LOCATE 1,5: PRINT " ** DISK HANDLER DEMONSTRATION **" : PRINT
110 '
120 ' ** FIND DEFAULT DRIVE
130 '
140 FIND%=1:SET%=2:DISKPARM$=SPACE$(1)
150 PRINT "Find the default drive"
160 DISKOPT%=FIND%
170 PRINT "  *** Subroutine call"
180 CALL DISK (DISKOPT%,DISKPARM$) : SAVDRV$ = DISKPARM$
190 PRINT "Got back and DEFAULT DRIVE is " CHR$(34) DISKPARM$ CHR$(34)
200 PRINT
210 '
220 ' ** SET DEFAULT DRIVE
230 '
240 PRINT "Now let's set a new default drive" : LOCATE ,,1 : BEEP : PRINT
250 PRINT "Specify NEW default drive letter (A B C D) :";: GOSUB 460
260 DISKPARM$ = KY$ : DISKOPT%=SET%
270 PRINT "  *** Subroutine call"
280 CALL DISK (DISKOPT%,DISKPARM$)
290 PRINT "Return from subroutine call and new default should be set"
300 '
310 ' ** FIND OUT IF IT REALLY CHANGED
320 '
330 PRINT
340 PRINT "Find out if default drive really changed"
350 DISKOPT%=FIND%
360 PRINT " *** Subroutine call"
370 CALL DISK (DISKOPT%,DISKPARM$)
380 IF DISKPARM$ <> SAVDRV$ THEN 420
390 SOUND 50,7 : COLOR 0,7
400 PRINT "Default drive NOT changed. Invalid or same drive letter specified!"
410 COLOR 7,0 : GOTO 440
420 PRINT "It changed! The default drive is now " CHR$(34) DISKPARM$ CHR$(34)
430 SOUND 500,1 : SOUND 400,1
440 END
450 '
460 '   **** KEY-IN ROUTINE
470 '
480 KY$ = INKEY$ : IF KY$ = "" THEN 480
490 '
500 '   ** CHECK FOR SMALL OR CAPITAL LETTERS
510 '
520 IF KY$ < CHR$(97) OR KY$ > CHR$(122) THEN 570
530 '
540 '   ** CHANGE LOWERCASE TO UPPERCASE
550 '
560 KY$ = CHR$(ASC(KY$)-32)
562 '
570 PRINT KY$
580 RETURN
```

Figure 2.

Looking into the Assembly Code. The subroutine first determines what type of operation is to be performed (find or set). To do the actual function call for finding the default drive, the hex value 19 is placed in register AH and an INT 21H is executed. The currrent default drive is returned to the subroutine in register AL in the form of a number (0 for drive A, 1 for drive B, and so on). Since the Basic program that wants to know the default drive expects to see a drive letter, the number in AL must be converted to a letter. This conversion is done by means of an INC (increment instruction, line 27), which adds 1 to the value in register AL. Next, in line 28, the high portion of the AX register (AH) is cleared to 00. In the next line, the value in AL is ORed with hex 40 to change the number to a letter. Let's look at how this change is done.

Assume, for illustration, that the AL register contains 01 after we've done a function call to find the default drive. This means drive B is the default drive. The value 01 in binary is 0000 0001. When the INC instruction is executed, the value in AL changes to 0000 0010. The effect of ORing this number with hex 40 can be seen from the following:



	Hex	Binary
Register AL	02	0000 0010
is ORed with	40	0100 0000
resulting in	42	0100 0010

The OR instruction in this case puts a value of 42 in register AL; hex 42 represents the letter B in ASCII. You can see that drive specifications of A, C, or D would work in very much the same way. Thus the number returned by the function call is converted to the appropriate letter.

The final step of the find exercise is to retrieve the location of Diskparm$ from the

stack, stick the drive letter into Diskparm$, and return to the Basic program.

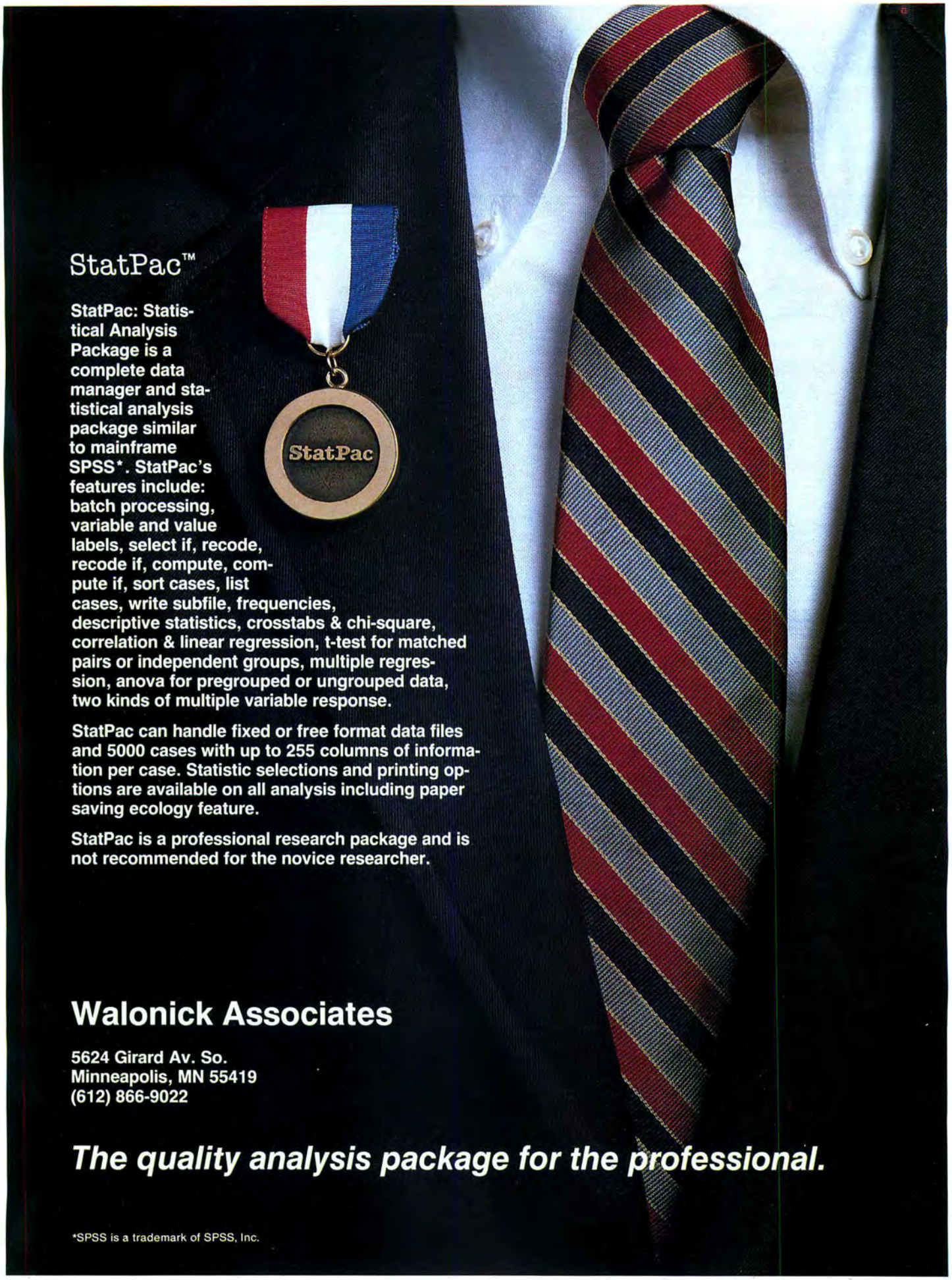
The set default drive function works pretty much the same way, except in reverse order. The new default drive letter is retrieved from Diskparm$ and placed in the DL register. In this case the letter must be changed to a number for the function call. To make this conversion, the contents of DL are XORed (exclusive ORed) with hex 40. Here's what that operation looks like (we'll use drive B again as an example):

	Hex	Binary
Register DL	42	0100 0010
is XORed with	40	0100 0000
resulting in	02	0000 0010

The XOR instruction (for drive B) puts a value of 02 in register DL. Next the DEC (decrement) instruction changes that 02 to 01, which the function call interprets as drive B. All that is left to do is load the hex value 0E into register AH and execute the INT 21H again. At the completion of the function call, the new default drive has been set.

```
                ; DISK HANDLER
                ;
                ; THIS ROUTINE WILL HANDLE DISK MANIPULATION
                ;   AND IS CALLED FROM BASIC
                ;
                ; IF OPTION = 1 THEN BASIC WANTS TO KNOW DEFAULT DRIVE
                ;
                ; IF OPTION = 2 THEN BASIC WANTS TO SET THE DEFAULT DRIVE
                ;
                ; WRITTEN BY HOWARD GLOSSER
                ;
0000            CSEG    SEGMENT
                        ASSUME CS:CSEG
0000            DISK    PROC    FAR
0000 55                 PUSH BP             ;SAVE BP FOR FAR RETURN
0001 8B EC              MOV BP,SP           ;MOVE STACK POINTER TO BP
0003 8B 76 08           MOV SI,[BP]+8       ;POINT SI AT PARM 1
0006 8B 14              MOV DX,[SI]         ;GET DISKOPT% IN DX
0008 83 FA 01           CMP DX,1            ;IS IT OPTION 1?
000B 74 08              JE  FIND            ;YES - GO FIND DEFAULT
000D 83 FA 02           CMP DX,2            ;IS IT OPTION 2?
0010 74 10              JE  SET             ;YES - GO SET DEFAULT
0012 EB 2A 90           JMP RETURN          ;INVALID OPTION - JUST RETURN
0015            FIND:
0015 B4 19              MOV AH,19H          ;SET AH FOR FUNCTION CALL 19H
0017 CD 21              INT 21H             ;DOS INTERRUPT
0019 FE C0              INC AL              ;ADD 1 TO AL TO ADJUST DRIVE
001B 32 E4              XOR AH,AH           ;CLEAR AH REGISTER TO ZERO
001D 0C 40              OR AL,40H           ;CHANGE DRIVE NUMBER INTO LETTER
001F EB 15 90           JMP LDPARM          ;GO RETURN IT IN DISKPARMS
0022            SET:
0022 8B 76 06           MOV SI,[BP]+6       ;POINT SI AT PARM 2 ADDRESS
0025 8B 7C 01           MOV DI,1[SI]        ;MOVE DISKPARMS ADDRESS TO DI
0028 8B 15              MOV DX,[DI]         ;MOVE DRIVE LETTER TO DX
002A 80 F2 40           XOR DL,40H          ;CHANGE DRIVE LETTER TO NUMBER
002D FE CA              DEC DL              ;SUBTRACT 1 TO ADJUST DRIVE
002F B4 0E              MOV AH,0EH          ;SET AH FOR FUNCTION CALL 0EH
0031 CD 21              INT 21H             ;DOS INTERRUPT
0033 EB 09 90           JMP RETURN          ;NOTHING TO RETURN - GO TO BASIC
0036            LDPARM:
0036 8B 7E 06           MOV DI,[BP]+6       ;POINT DI AT DISKPARMS ADDRESS
0039 8B 75 01           MOV SI,1[DI]        ;MOVE ADDRESS TO SI
003C 88 04              MOV BYTE
                        PTR[SI],AL          ;MOVE DRIVE TO WHERE SI POINTS
003E            RETURN:
003E 5D                 POP BP              ;RESTORE BP OFF STACK FOR RETURN
003F CA 0004            RET 4               ;FAR RETURN-2 PARMS IN STACK
0042            DISK    ENDP
0042            CSEG    ENDS
                        END
```

Figure 3.



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THE PROFIT PLOT

by Jack Grushcow

Spreadsheets and the Securities Market, Part I

Readers often request that a few installments of Profit Plot be devoted to the creation of spreadsheets for stock investing. Experts estimate that one in every six American adults owns stocks and that the total value of stocks held by Americans is somewhere around $8 billion.

Over the next few months we'll get an overview of portfolio management and securities and see how spreadsheets can aid in managing them. Because of the large amount of money this involves and the interest the subject generates, and because spreadsheets can help make (and lose) money, it makes sense to start by covering some basic investment ground rules. Before we begin, a note of caution: Selecting stocks can be a tricky business, so it's wise to discuss your ideas with an investment professional before making any investment decisions.

Spreadsheets and Investing. When you begin managing your own investment portfolio, you will be faced with three main areas of concern.

The initial analysis stage—selecting the investments that will make up your rudimentary portfolio—comes first. Investment monitoring—keeping your investments current and your portfolio filled with the most profitable investments you can find and afford—is a more challenging concern. Your final task is investment bookkeeping—checking to be sure that you receive dividends, that you exercise or sell rights and warrants, and that you collect the interest income you are entitled to. Your bookkeeping will also help you keep aware of your tax exposure.

In forthcoming columns we will build spreadsheets to handle the selection, monitoring, and bookkeeping aspects of investments. But let's start with a look into the reality of high finance and see what we find among the bulls and the bears.

Creating Your Portfolio's Personality: Who Are You?

Portfolio management begins with the initial selection of securities. Before you can begin selecting securities you have to define your own investment objectives. This is a good opportunity to examine your future financial, career, and total life plans and goals in order to discover what kind of investor you are. Portfolios are flexible; they can be constructed to suit investors of any temperament. Like good paintings, portfolios can echo the characters of their creators—from the most aggressive to the most conservative.

Portfolios usually represent a balance between income and growth, with income representing the more conservative end of the strategy spectrum and growth stock the more aggressive.

Finding your particular blend of investments takes experience. Professional guidance is indispensable, especially for the less experienced investor. And by taking the time to examine your personal investment goals you'll put yourself in a better position to get the most out of any professional advice you seek. No advisor can really help you until you've articulated your particular investment goals.

Here is a list of areas you should think about before you talk to any investment professional. Some areas, such as number of dependents and age, are obvious. Other factors, such as how you feel about assuming risk or the income level you want to experience during retirement, may take a bit more soul searching.

Investment Profile

Concrete	Abstract
Age	Temperament
Dependents	Interest
Income	Time
Financial resources	Ability
Tax situation	Future income level desired
Current level of debt	

The left column will help you outline your current status and resources; these topics are relatively self-explanatory. They will help you paint your self-portrait as far as your earning capability, growth prospects, and financial commitments are concerned.

The right column deals more with your inclinations. You may be willing to take considerable investing risks. If so, common stocks may appeal to you. Or you may feel that the risk associated with owning common stocks causes too much stress. If so, you'll want to focus on the creation of a more stable type of portfolio that concentrates on income and maintenance of capital. Discovering your investment temperament will help you select the types of investments best suited to your needs. Many people gain a new personal clarity from this process of self-definition.

The right side of the investment profile also helps you determine the role you will play in selecting investments. Do you have the time to keep up to date with the ever-changing investment market? Do you have training in economics, statistics, or other related areas to help you in the analysis of investments? By answering these questions you can determine how much and what type of help you will need to build your personal investment portfolio.

Three Types of Securities

There are basically three categories of securities available to the investor: common stock, preferred stock, and debentures or bonds. The various securities can be combined to create an aggressive or defensive portfolio.

Common Stock. Common stock represents ownership in a company; corporations issue shares and receive equity capital in return, which they then use for their various operations.

Owning common shares entitles an investor to corporate earnings after prior claims such as interest, dividends owed to preferred shareholders, and taxes have been paid by the corporation. This participation in earnings occurs in two ways. First, the success of a company often translates into a higher price for its stock, which means the common shareholders' investment grows in value. Second, companies usually put some of their profits back in shareholders' pockets by paying dividends periodically in the form of cash or additional stock.

In addition, a common shareholder has the

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right to elect members to the board of directors and to vote on company policy. The common shareholder is also entitled to attend annual meetings and receive a copy of the company's annual report.

When compared with preferred stocks and bonds, common stocks offer an investor the greatest potential for capital gain. However, with this added profit potential comes added risk. There is no guarantee that the value of the company's stock will increase or that dividends will be paid.

The success or failure of a company will usually control the market value of its stock, while the board of directors will decide if and when dividends will be paid. When a company has a poor year it may very well elect to pass on paying dividends, deciding instead to retain this cash for future use. Should a company go bankrupt, the common shareholders have to wait in line behind the bond and preferred shareholders to recover their investments. If there are not enough assets to go around, then the common shareholders run the greatest risk of being left out in the cold.

Preferred Stock. In terms of having a claim to a company's assets, the preferred stock shareholder occupies a position between the bond holder and the common shareholder. The preferred shareholder is entitled to a fixed rate of return paid out in the form of dividends; although preferred shareholders are always assured that their dividend will be paid before the common shareholders get theirs, they don't participate in the growth of the company over and above the fixed dividend. They forego the possibility of future profits to be asssured of a prior claim to dividends.

Things usually have to get pretty bad before a company misses a preferred dividend payment. Missing a preferred dividend harms a company's general credit rating and impairs its ability to raise funds through equity financing in the future.

Preferred shares come in many varieties and have diverse entitlements. They are usually cumulative, which means that any missed dividends accumulate and must be paid off before a common dividend is paid. Also, once the company misses payment of a dividend, preferred shareholders can usually appoint members to the board of directors.

Participating preferred shareholders have limited rights to share in the earnings of a company over and above the specified dividend rate. For example, the Loblaw Groceteria offers a $.50 participating preferred issue. When the common stock has earned $.50 per share, the participating feature takes effect. Any dividends beyond this $.50 level are divided equally between the common and preferred shareholders.

Another variety of the preferred stock is the convertible preferred. It allows preferred shareholders to convert their stock into common shares of the company at a specified price, giving the preferred shareholder the opportunity to participate directly in corporate growth. For instance, the $2.12 convertible preferred shares of Pitney Bowes stock are convertible into the company's common stock on a 1 for 1.47 basis; each convertible share held can be turned into 1.47 shares of the underlying common stock.

Because of current tax laws you will usually receive a higher rate of return on a quality corporate bond than on a preferred stock. This is because 85 percent of the dividends from a U.S. company are tax exempt when held by another U.S. company. Thus, U.S. Steel may find it highly profitable to have some of its cash sitting in AT&T preferred stock. U.S. Steel would earn a nice return on the investment, since 85 percent of such income would be tax free. Companies will pay more for a preferred stock because a great deal of the income earned is tax exempt.

Bonds. Bonds and debentures make up the third category of securities. When you buy a bond or debenture you actually make a loan to the issuer. A bond differs from a debenture in that a bond is a secured promise to pay, backed

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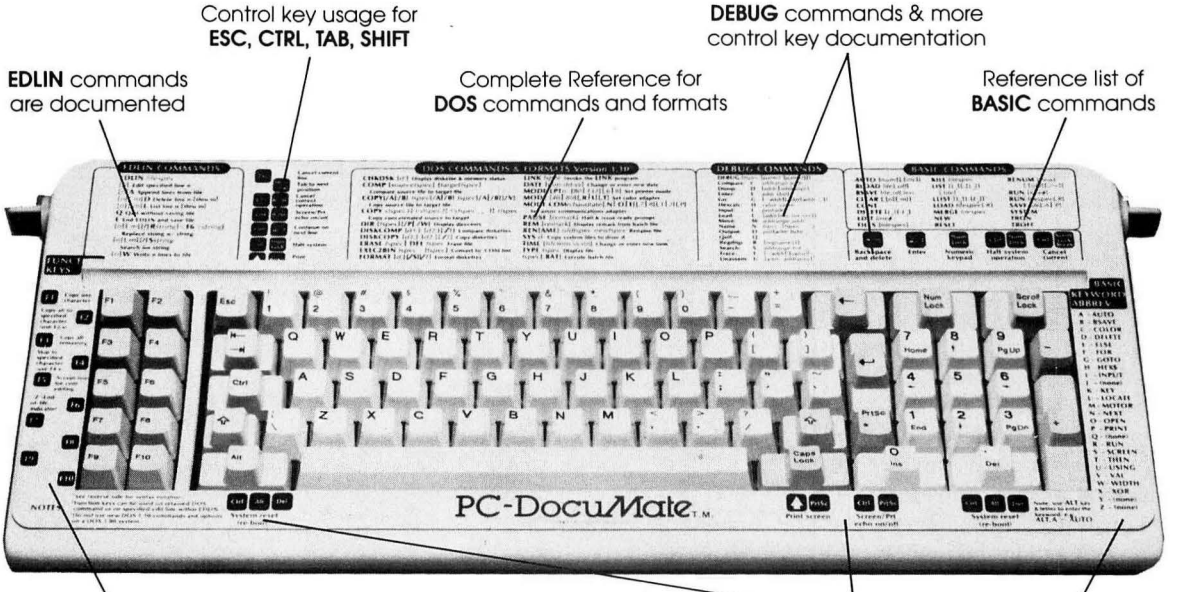

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up by a specific asset. Corporate debentures are unsecured loans and rely solely on the credit rating of the company that issues them. Both of these securities pay out interest over a specified term; after the term is over it is up to the borrowing company to repay the principal or face amount.

Both bonds and debentures guarantee repayment of principal at maturity and payment of interest on a regular basis as long as corporate funds are available. Neither bonds nor debentures participate in the growth of the company.

The railways serve as an interesting example of companies that issue bonds: They make use of equipment trust bonds as a way to finance rail cars. The railroad will pay 20 percent down on a rail car; the balance is financed by the sale of bonds secured by the equipment itself. The title of the rolling stock is held by a trustee who leases it to the railway for a rental period sufficient to pay the interest and the debt on the rolling stock.

Other bonds differ mainly in the collateral used to secure the loan. For instance, mortgage bonds, as the name implies, pledge land or buildings as security. Collateral trust bonds aren't secured by property but by the physical pledge of other securities.

Fixed income securities come with a wide variety of options designed to attract investors, but in times of high inflation investors don't want to be locked into earning a fixed rate of interest over a long period of time. Because of this, some debentures are retractable. The retractable debenture is initially a long-term note, usually a twenty-year note, but it gives the investor the option to redeem the certificate at an earlier date. In times of rapidly changing interest rates, this allows the investor to avoid being locked into a low-yielding investment.

On the other hand, some debentures offer the extension feature, the opposite of the retraction feature. This gives the investor the opportunity to extend the maturity date beyond the initial term of the bond. Both retracting and expanding securities are referred to as having variable maturities, since the investor has the option of either lengthening or reducing the securities' terms.

Many debentures come with a conversion option that allows the owner to convert the debenture into a specified amount of the issuer's common stock at a specified price. For example, Eastman Kodak has a convertible debenture that pays 4.5 percent interest. At any time the bond holder can convert the bonds into common stock at a cost of $96 for each common share purchased.

Companies can also make their debt issues more attractive to the public by attaching warrants to some debentures, allowing the investor to purchase a specific amount of common

stock at a specific price. Warrants must be exercised by a specific date, after which they expire.

The chart below summarizes our simple introduction to securities.

Creating a Portfolio

You now have a general idea of the types of securities available in the marketplace. Let's examine how these various securities can be combined to create portfolios suiting different investors' objectives.

Securities can be categorized as contributing either income or growth to an investor's portfolio. Income-producing securities represent a more defensive, conservative investment strategy, while growth stocks represent a more aggressive investment stance. By selecting the appropriate balance of growth and income stocks you can customize your portfolio to meet your particular investment objectives.

Growth Stocks—Past and Present. Growth stocks are identified by their superior earnings records compared to other stocks within their industry. Growth companies consistently outperform the stock market averages as well as the economy in general. Perhaps the easiest way to see what types of stocks are considered growth stocks is to examine the growth industries of previous decades.

In the fifties several industries experienced fantastic growth. With the television boom, stock in Admiral rose from $7 a share to over $80 in less than two years, while Zenith more than doubled from $30 to $70 in the first six months of 1950. This spectacular growth took place while the stock market in general was in the doldrums.

The sixties saw a virtual kaleidoscope of industries vying for investors' attention. The growth of leisure-related industries—electronics, computer-leasing, soft drink, and retail companies—created periods of excellent growth. Perhaps the most alluring companies were the large conglomerates. The massive expansion of IT&T, Gulf and Western, and Textron through acquisition had many investors paying huge earnings multiples for stock in these companies.

Throughout the seventies the stock market was sluggish, yet several companies experienced fantastic growth—for example, the fast-food giant McDonald's and such computer companies as Texas Instruments and Hewlett-Packard. Fears about oil supplies contributed to the growth of Standard Oil and Mobil Oil.

The eighties' superstars number both computer hardware and software companies among them, but medical systems and bioengineering have also been powerful forces in the market. In many cases these growth industries pioneered new products and technologies; they captured the investors' imagination. Through aggressive management their modest resources were parlayed into vast empires.

How do you spot growth stocks? Easy—they show better earnings than the rest of the pack. However, you will have to pay a premium for these stocks. Their future looks so bright that investors are willing to pay more today on the promise of participating in future growth. Since many of these industries are in the formative stages of growth, the companies tend to plow earnings back into the company to finance expansion and fund their large research and development commitments.

A good growth company should show an above-average rate of return on invested capital. This indicates that management is effectively handling its capital resources; an above-average rate of return also signals that the market actually desires the company's product or service. This superior rate of return should also be combined with a steady growth in sales volume. Both of these indicators carry more weight if they have happened over a period of several years.

A growth company must be managed by capable, aggressive people who are willing to assume calculated business risks, because these companies break the ground for new industries and create new products. There is no well-worn path to success.

Selecting the right industry is the most important factor in finding a good growth stock. Being aware of the needs of the buying public as well as judging the impact of changing technology is of major importance.

Selecting growth stocks is a very difficult task. You must see the potential in these companies before other investors see it; if you don't, you run the risk of paying such a high price for the stock that future growth prospects are already discounted by the price.

Nonetheless, growth stocks will provide your portfolio with a bulwark against inflation. The goal of these investments is not to protect the principal amount of your investment, but rather to provide you with some real capital appreciation. These stocks will make up the aggressive section of your portfolio.

Income Stocks. At the other end of the investment spectrum we find the income stocks that you select to provide your portfolio with regular income and capital protection. Selecting income stocks is easier than selecting winning growth stocks. Good candidates for the income-conscious investor are stocks in mature companies within well-established industries.

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You must consider many factors in evaluating the quality of a security. A company's cash flow, return on equity, profit margins, and other factors are important when determining whether you want to invest in a company.

Income and growth stocks each have their own place in the portfolio. Generally speaking, the younger the investor the greater the proportion of growth to income securities in the portfolio. Since younger investors won't be retiring as soon, investment in growth stocks is important to provide the portfolio with real growth in the face of inflation. Preserving principal is less important since young investors have many years of earnings ahead.

As they grow older these investors will gradually shift away from a more aggressive, growth-oriented portfolio to one better suited to provide income in the retirement years. This older investor's income-oriented portfolio stresses safety of principal and continuance of income.

This month's Profit Plot has introduced you to some general features of the securities market. Next month we will build a spreadsheet to analyze financial statements and calculate thirteen different financial ratios to use in measuring a company's financial pulse in the areas of liquidity, solvency, efficiency, and profitability. The first application area we will explore will be investment selection. ▲

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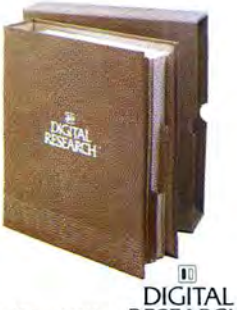

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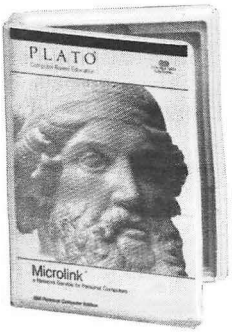

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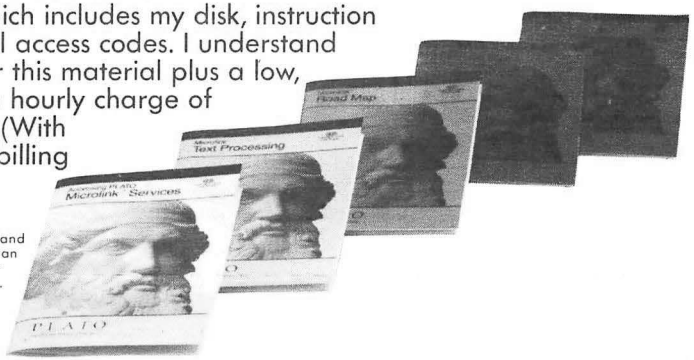

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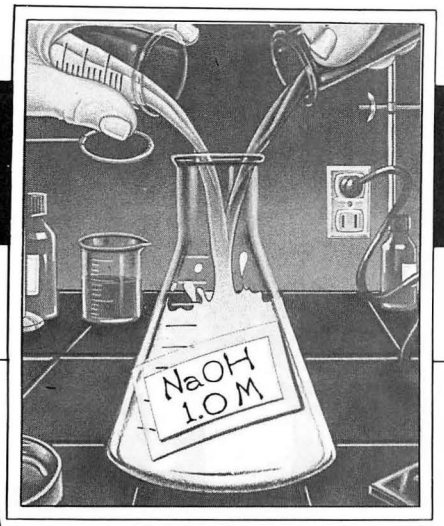

by Joe Juhasz

How To Beat the Garbage Collector

Does the following scenario sound familiar? You're using a Basic program to keep track of your clients. You've been adding names to your file for quite a while, and everything seems to be operating smoothly. You press enter to add another client—and nothing happens. Several seconds go by. Still nothing. Your system appears to be asleep—or maybe even dead.

Finally you've waited long enough, and you decide to press control-break to stop the program. Still nothing happens! You're just about to reset the machine when suddenly it comes back to life.

You've just endured an episode of Basic housecleaning—or, as it's more affectionately described, garbage collection.

Garbage collection is the process of reclaiming used-up string data space. And as you probably know from firsthand experience, it's a nuisance.

It's not uncommon for a Basic string variable to take on values of varying length during the run of a program. For example, in your program to track client data, you may at one point assign the value "Boston" to the variable City$; at another you may assign to the same variable the longer value "Philadelphia". To cope with this variability in length, Basic stores your string variable data in a different memory location each time you reassign a variable.

The result of this continual relocation of string variable data is that the area of memory reserved for string data becomes increasingly fragmented during the course of a program run. Eventually the interpreter runs out of usable string storage space, and then it automatically performs its infamous garbage collection. The Basic statement *temp!=fre("")* can be used to force an immediate garbage collection. Early versions of the IBM Basic manual indicated that you could use *fre ("")* periodically to get shorter delays for each collection, but *this is not true*! For any given program, each garbage pickup takes approximately the same amount of time, regardless of how much garbage there is to collect.

You can discover this for yourself by putting consecutive *fre("")* statements into a program. The second collection will take as long as the first, even though the house has obviously just been cleaned.

Fre(0) returns the amount of usable string space remaining in memory; it can be used to control when and how garbage collection takes place. If there's no way to avoid garbage collection, you should include it in your program statements like this:

```
IF FRE(0) <500 THEN PRINT
   "...Collecting Garbage..." :
   TEMP!=FRE("")
```

to force a cleanup and warn whomever's using your program. This technique does not speed up garbage collection or make it occur less often, but it does reassure your user.

Garbage collection can take anywhere from less than a second to a good ten minutes or more. The major factor determining the length of time the process takes is the number of string variables in your program; the more string variables, the longer the cleanup.

The following lines of code show the creation and pickup of string-variable garbage. On

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a 128K machine this program results in about an eight-minute delay.

```
100 CLS
110 DIM A$(8000)
120 FOR I=1 TO 8000
130  LOCATE 10,25: PRINT I;
     " AVAILABLE STORAGE
     =";FRE(0)
140  A$(I)=STRING$(30,CHR$
     (I MOD 220+27))
150  IF FRE(0) > 100 GOTO 210
160   PRINT "... Garbage collection
     taking place ..."
170   PRINT "Start time
     = ";TIME$
180   A!=FRE("")
190   PRINT "End time    =
     ";TIME$
200   STOP
210 NEXT
```

There are two ways to combat garbage collection. The first is to minimize or eliminate string space fragmentation; the second is to shorten the amount of time needed for the collection process.

To minimize and eliminate string space fragmentation, you need to avoid those statements and programming techniques that cause fragmentation. To do that, you need first to learn a little about what Basic does when it assigns values to string variables.

Whenever a Basic string variable is assigned a new value, new storage is allocated, and the storage space formerly occupied by the variable becomes "garbage." For example, the statement *A$ = "1234567"* causes the interpreter to allocate seven bytes for the data assigned to A$. The statement *A$ = "1234"*, occurring subsequently in the same program, causes the interpreter to allocate four new bytes for A$ and to abandon the seven bytes that held the variable's original data.

Basic doesn't concern itself with whether the new value of a reassigned string variable is longer or shorter than the former value. It takes the rather inefficient short cut of allocating new storage and putting the old space on the garbage pile—regardless of whether the new value is longer or shorter than the old.

String variable assignments are by far the greatest cause of storage fragmentation. Other major causes are the use of the functions *left$* and *right$* and the concatenation of strings.

The major tools for avoiding string space fragmentation are the commands *lset*, *rset*, and *swap*, and the function *mid$*. We'll look at *lset* and *rset* this month and save the others for later.

The commands *lset* and *rset* cause Basic to reuse a variable's original storage space; they do not create garbage. *Lset* left justifies and *rset* right justifies a new value into a variable's current storage space. If the new value is too long to fit into the space currently occupied by the variable's data, then characters are lost; if the opposite is true—if the new value is shorter than the current value—then the storage area is padded with spaces.

Here are some examples:

```
                                          Result
A$ = SPACE$(5)
PRINT A$;" free=";FRE(0)                  free=xxxx
LSET A$ = "abcdefghij"
PRINT A$;" free=";FRE(0) abcd             free=xxxx
LSET A$ = "1"
PRINT A$;" free=";FRE(0)  1               free=xxxx
```

Thus, if you know that your variables will always be of the same length, or if you know that you can treat it as though it were always of the same length, you can eliminate most garbage collection. But remember, to use *lset* or *rset* in this manner, you must first assign the string variable a value with the desired length. Use a statement such as *A$=space$(5)*, for example, to create space for five characters. It's best to put this kind of statement in an initialization routine at the start of your program before any other reference to the variable.

Next month we'll look at the use of the Basic function *mid$*, as well as other methods to avoid string storage fragmentation. ▲


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BLOCK THAT PRINTSCREEN!

by Kevin Goldstein

The first time it happens you sort of blame yourself. After all, you had hit a jumble of keys flailing around after that &*%$&^ shift key. Of course, it didn't seem you should be punished by having the whole blessed thing crash— bad enough that IBM had been so arrogant as to give the pc a keyboard unlike anything any typist this side of the Atlantic had ever seen, but to then let a bug crawl through that caused the system to freeze up solid when some mysterious combination of keys got hit—well, that was just too much.

On the other hand, there was not a whole lot that could be done about it, save a little cursing—or maybe a lot, if much work was lost—followed by a reboot.

The next time it happened you probably were much less surprised, and also much more annoyed. And one of those times, while staring at your frozen display unbelievingly, wondering what an Apple was like—lo and behold, your machine came back to you, all your work still intact. It was then that the recognition hit that your machine wasn't really crashing. Henceforth, whenever the pc took a break in similar circumstances, you simply turned on your printer, because by now you realized you had accidentally hit the combination of a shift key and the print-screen key. Your dead computer had simply been timing out on an unavailable printer.

Once you knew the cause, the problem wasn't devastating, only annoying, and the solution was as simple as waiting for the "device time-out" or turning on the printer.

Unless you were working at a Compaq. If that were the case, an accidental print-screen with no printer available turned out to be either totally devastating or incredibly annoying. Devastating if you didn't realize just how long the device time-out on a Compaq is. Really annoying if you did. The Compaq being schleppable, it's likely to be used quite often with no printer attached.

There is, fortunately, a fairly simple way around the whole problem, which we present here. The heart of the solution is to recognize that most of the time the problem is caused when your right finger overreaches the absurdly small right shift key and mashes down between that key and the one to its right—the PrtSc key. The answer is a simple little program that disables that particular combination of keys; after you run *Prtscfix*, only the left shift key and PrtSc key combination will result in a print-screen interrrupt; the right shift key and PrtSc will do nothing. For those of you without a printer, or those using a Compaq when on the road, we'll also show how to construct an alternative version of *Prtscfix*, which disables the PrtSc key altogether.

The program itself is a fairly short piece written in assembler. You won't have to play with the assembler to get a working version; listing 1 is a Basic program that writes the machine code directly onto a disk file. In the listing presented here, the program created is called *Prtscfix.com*.

Run the Basic program once to create the *Prtscfix* program and write it to a disk file. Then whenever you want to disable the right-shift PrtSc key combination, get into DOS and type *prtscfix*. You can run the program command more than once, but don't: All you'll do is load up memory with identical copies of the program. The easiest thing to do is add the *prtscfix* command to your Autoexec.bat file.

You may wish to create a second version of *Prtscfix* that disables the PrtSc key altogether. To do that, make the following three changes to the Basic program before running it:

1. In line 60, change *check = 12* to *check = 14*.
2. Change the name of the program file being created: In line 110, change *open "prtscfix.com"* to *open "prtsckil.com"*.
3. In line 230 change *data 1* to *data 3*.

If you create both versions of the program, you have a choice: You can limit the print-screen call to the left-shift PrtSc key combination, or you can eliminate it altogether.

How It Works. The basic idea behind *Prtscfix* is the same as the concept of *Scrollk*, a program by John Socha that enables the scroll-lock key to toggle the pc into a page display mode for convenient reading of multipage documents (see "The Scroll Lock Mystery Solved," *Softalk*, May 1983). Both programs redirect an interrupt from the BIOS to a specially written routine added to DOS. In the assembly listing for *Prtscfix*, the code from the label Load_vector to the end of the listing is responsible for repointing the PrtSc interrupt vector, located at address 14H (segment 0). This section of code also saves the original interrupt vector (at address Rom_prnt_scrn_vec), so that a valid call to print-screen—that is, one that comes as a result of the left shift and PrtSc—can be passed through.

The routine itself is quite short, consisting mostly of saving and restoring registers. The key line is the AND instruction. Since the right shift key sets the low-order bit at address 417H (offset = 0), the AND instruction simply tests to see if that bit is set; if it is, the zero flag will not be set, and the subsequent JNZ (jump not zero) instruction will jump around the call to the ROM BIOS print-screen routine.

The left shift key is represented by the second bit of the byte at location 417H (see the article cited earlier for a more complete discussion of the status byte at location 417H). If the mask for the AND instruction is changed to cover both of those bits, then any call to print-screen will be aborted. If you look at the Basic program, you'll see the mask is found in the *data* statement at line 230; changing it to a 3, or binary 11, effectively does the job. It would have been possible, of course, to create an even smaller program for the version of *Prtscfix* that completely kills the print-screen call; you might try that if you're hot to do some assembly language programming. The space saved will be quite small, but you might still consider it worth the effort.

```
10 CHECK=0
20 FOR I = 1 TO 67
30 READ BYTE
40 CHECK = CHECK XOR BYTE
50 NEXT I
60 IF CHECK = 12 THEN 110       'Change to CHECK = 14 for PrtSc kill.
70 PRINT "One of the data statements has an error or is missing,";
80 PRINT "or there is an error in lines 10 to 50. Check the data";
90 PRINT "statements in lines 200 to 300 and lines 10 to 50 and run again."
100 STOP
110 OPEN "prtscfix.com" AS #1 LEN = 1  'Change name for PrtSc kill.
120 FIELD #1,1 AS BYTE$
130 RESTORE
140 FOR I = 1 TO 67
150 READ BYTE: LSET BYTE$ = CHR$(BYTE): PUT #1
160 NEXT I
170 CLOSE
180 PRINT "PRTSCFIX.COM created."     'Change name for PrtSc kill version.
190 END
200 DATA          235, 31,  144, 0,   0,   0,   0,   251
210 DATA          30,  83,  80,  187, 0,   0,   142, 219
220 DATA          160, 23,  4,   36
230 DATA          1                   'Change to DATA 3  for PrtSc kill.
240 DATA          88,  91,  31
250 DATA          117, 6,   156, 46,  255, 30,  3,   1
260 DATA          207, 184, 0,   0,   142, 216, 161, 20
270 DATA          0,   46,  163, 3,   1,   161, 22,  0
280 DATA          46,  163, 5,   1,   184, 7,   1,   163
290 DATA          20,  0,   140, 14,  22,  0,   186, 33
300 DATA          1,   205, 39
```

Listing 1.

```
PRNT_SCRN_VECTOR        SEGMENT     AT 0h
                        ORG         5H*4            ;Print screen is int 5, adr 14H
PRNT_SCRN_INT           LABEL       DWORD
PRNT_SCRN_VECTOR        ENDS
                        ;
                        ;
KEYBOARD_DATA           SEGMENT     AT 0H
                        ORG         417H
KEY_FLAG                DB          ?
KEYBOARD_DATA           ENDS
                        ;
                        ;
                        ;  When this program is run, control is
                        ;  passed to a procedure which resets the interrupt vector
                        ;  for PrtSc to point to CHECK_NOT_RIGHT. It then
                        ;  attaches the code preceding it to DOS and exits.
                        ;
                        ;
CSEG                    SEGMENT     PARA
                        ASSUME      CS:CSEG
                        ORG         100H
                        ;
CODE_STARTS:            JMP         LOAD_VECTOR
ROM_PRNT_SCRN_VEC       DD                          ;Storage for address of ROM routine
                        ;
                        ;
                        ;  On a print-screen interrupt, control will be passed
                        ;  to the following procedure.
                        ;
                        ;
CHECK_NOT_RIGHT         PROC        FAR
                        ASSUME      CS:CSEG
                        STI                         ;Turn interrupts back on.
                        PUSH        DS              ;Save any registers that this
                        PUSH        BX              ;  program destroys.
```

→

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```
                        PUSH    AX
                        MOV     BX,KEYBOARD_
                                DATA            ;Establish addressability of
                        MOV     DS,BX           ;  data
                        ASSUME  DS:KEYBOARD_
                                DATA
                        ;
                        ;
                        ;  All this was
                        prelude.  Now we
                        finally do some-
                        thing
                        ;  useful.
                        ;
                        ;
                        MOV     AL,KEY_FLAG
                        AND     AL,01H          ;This tests to see if the bottom
                                                ;  bit was set.  If so, we got
                                                ;  here because of the right
                                                ;  shift key, so exit.
                        POP     AX              ;We'll either exit directly, or
                        POP     BX              ;  call the ROM print-screen
                        POP     DS              ;  routine and then exit.  In
                                                ;  either case, restore register
                        JNZ     RETURN          ;Jump taken if right shift hit
                        PUSHF
                        CALL    ROM_PRNT_
                                SCRN_VEC        ;It was the left shift; call prt
RETURN:                 IRET                    ;And return
CHECK_NOT_RIGHT         ENDP
                        ;
                        ;  Now comes the routine to point the interrupt vector
                        ;    for print-screen at the previous procedure.
                        ;
                        ;
LOAD_VECTOR             PROC    NEAR
                        ASSUME  CS:CSEG, DS:PRNT_SCRN_VECTOR
                        MOV     AX,PRNT_SCRN_VECTOR
                        MOV     DS,AX
                        ;
                        ;  First save the current print-screen interrupt vector
                        ;
                        MOV     AX,PRNT_SCRN_INT
                        MOV     ROM_PRNT_SCRN_VEC,AX
                        MOV     AX,PRNT_SCRN_INT[2]
                        MOV     ROM_PRNT_SCRN_VEC[2],AX
                        ;
                        ;  Now reset the vector to point to our routine
                        ;
                        MOV     AX, OFFSET CHECK_NOT_RIGHT
                        MOV     PRNT_SCRN_INT,AX
                        MOV     PRNT_SCRN_INT[2],CS
                        ;
                        ;
                        ;  Interrupt 27H attaches a program to DOS, up to the
                        ;    location in the DX register.  We want to attach
                        ;    everything but this initialization procedure, which
                        ;    is no longer needed after it does its job.  Therefore,
                        ;    DX should get the address of the beginning of this
                        ;    initialization procedure.
                        ;
                        MOV     DX, OFFSET LOAD_VECTOR
                        INT     27H
                        ;
LOAD_VECTOR             ENDP
CSEG                    ENDS
                        END     CODE_STARTS
```

Listing 2.

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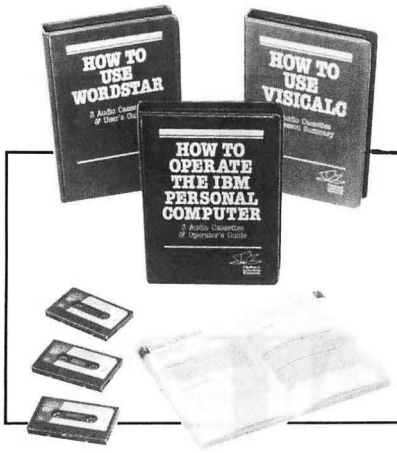

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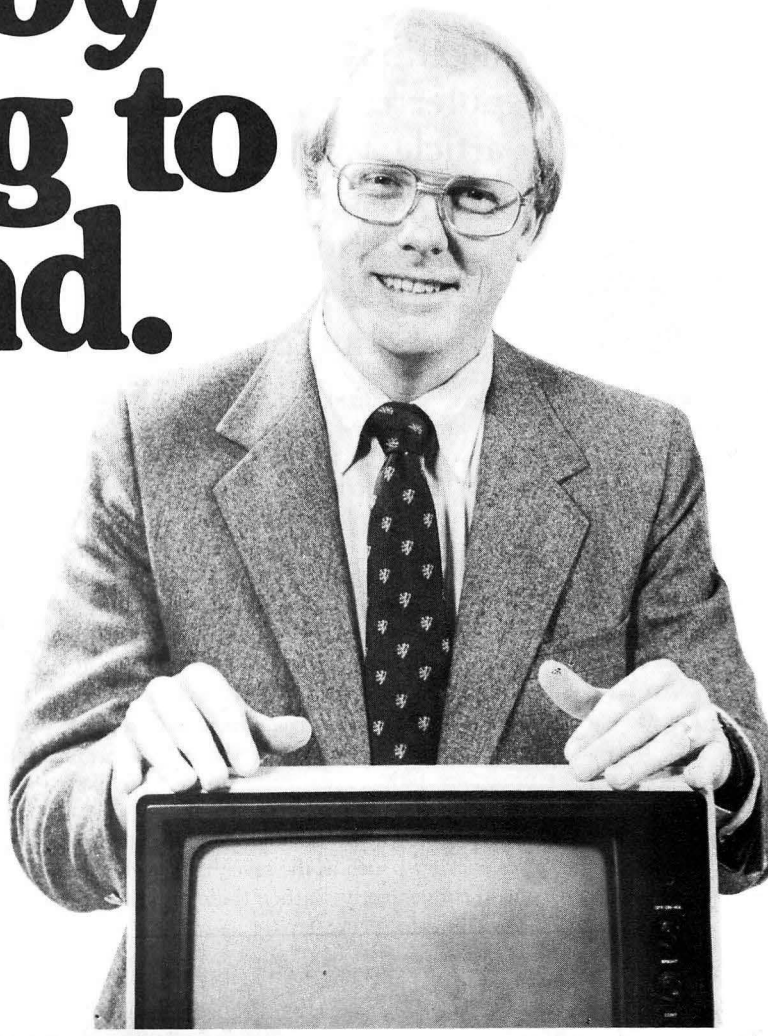

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NUMBERS INTO PICTURES

BY THOMAS BONOMA

BUSINESS GRAPHICS ON THE PC

Including graphics in your business reports and presentations can make a real difference in the quality and effectiveness of those communications. And being able to generate the graphics yourself on the computer can save you time, hassle, and expense. In the course of this article, we'll examine seven packages that generate presentation and/or analysis graphics on the pc.

For definition purposes, let's say that presentation graphics packages are those that generate high-quality graphic output, suitable for the production of slides and other documents to be shared with an audience. Analysis packages, in contrast, are designed to help you make sense of numeric data without necessarily generating such high-quality output.

On the analysis side, less concern is given to the way the finished output is presented. On-screen output may be limited to colorless presentations, and peripheral output may be limited to black-and-white dot-matrix hard copy. With presentation graphics packages a different set of conditions obtains. Screen presentations may be remarkably colorful and may even include a slide-show feature enabling many graphs to be strung together for use as a presentation. However, the main concern of a presentation graphics program is not the screen at all, but finished hard copy pictures that the user can include in reports, make into overhead transparencies, or otherwise share with professional peers. For these programs, plotters and color printers are likely to be the output devices of choice.

Of course, these are not sharply defined categories; analysis and presentation graphics packages, such as the seven reviewed here, do not split themselves out so conveniently. Rather, these programs occupy a continuum from almost pure analysis on the one end (*dGraph*, for example) to pure presentation on the other (*Graphwriter*, for instance). Most of the packages we'll examine in this review have some abilities in both arenas, though each package seems to offer a unique combination of features.

The seven packages considered in this article are *1-2-3* (Lotus Development Corporation), *Super Chartman II* (Graphic Software), *BPS Business Graphics* (Business and Professional Software), *Chart-Master* (Decision Resources), *Graphwriter* (Graphic Communications), *Fast Graphs* (Innovative Software), *dGraph* (Fox & Geller), and *PFS:Graph* (Software Publishing Corporation). The last two packages, *dGraph* and *PFS:Graph*, are different from the others in that they not only offer standalone business graphics capability but also contain "hooks" that effectively provide a graphics query system into a major database management program—*dBase II* and *PFS:File*, respectively.

Many other good programs could have been added to this list. But then you'd have been dealing with a graphics book, not a review. For example, *MBA*—a combination spreadsheet, DBMS, and telecommu-

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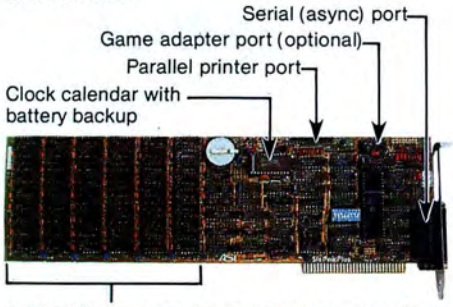

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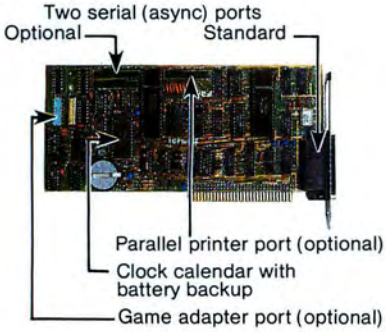
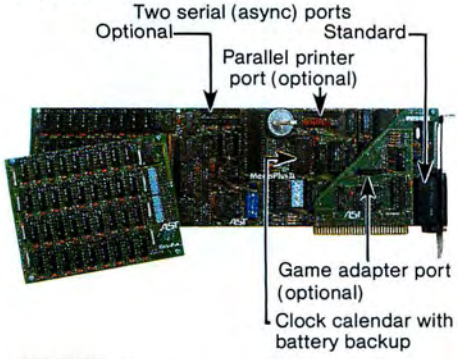


MegaPlus II™:



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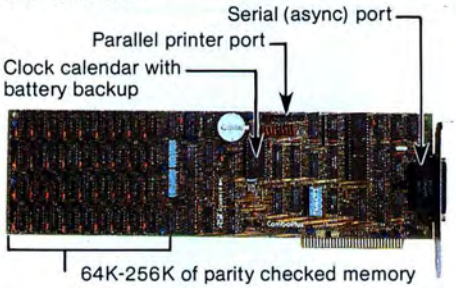
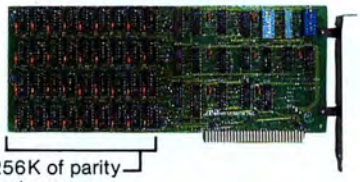


MP Expansion Memory:



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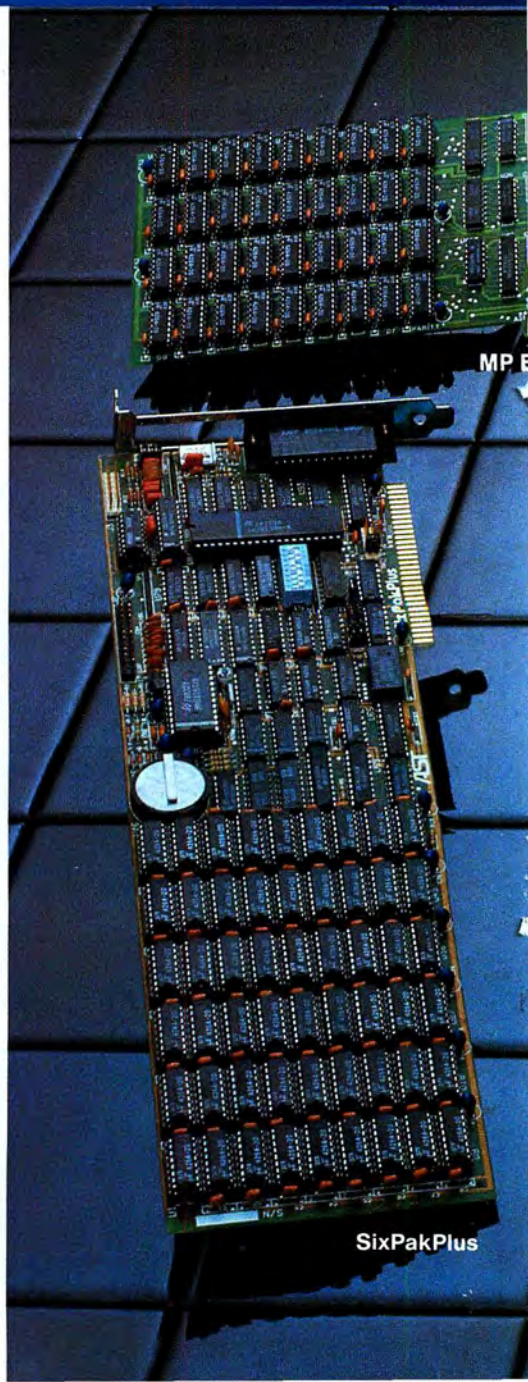

User Memory from 64K-512K — When added to your existing system memory, brings your PC up to its maximum of 640K. You can run larger spreadsheets or create larger in-memory databases. You can also use the additional memory along with the supplied AST SuperPak™ software which includes SuperDrive™ and SuperSpool™.

Serial Ports — Using a modem your PC can communicate with other computers over telephone lines. By connecting a serial printer, you can obtain high quality print output. Other serial devices such as a plotter or mouse may also be connected to a serial port.

Parallel Ports — Used for connecting a parallel printer to your PC for high-speed, draft quality printouts.

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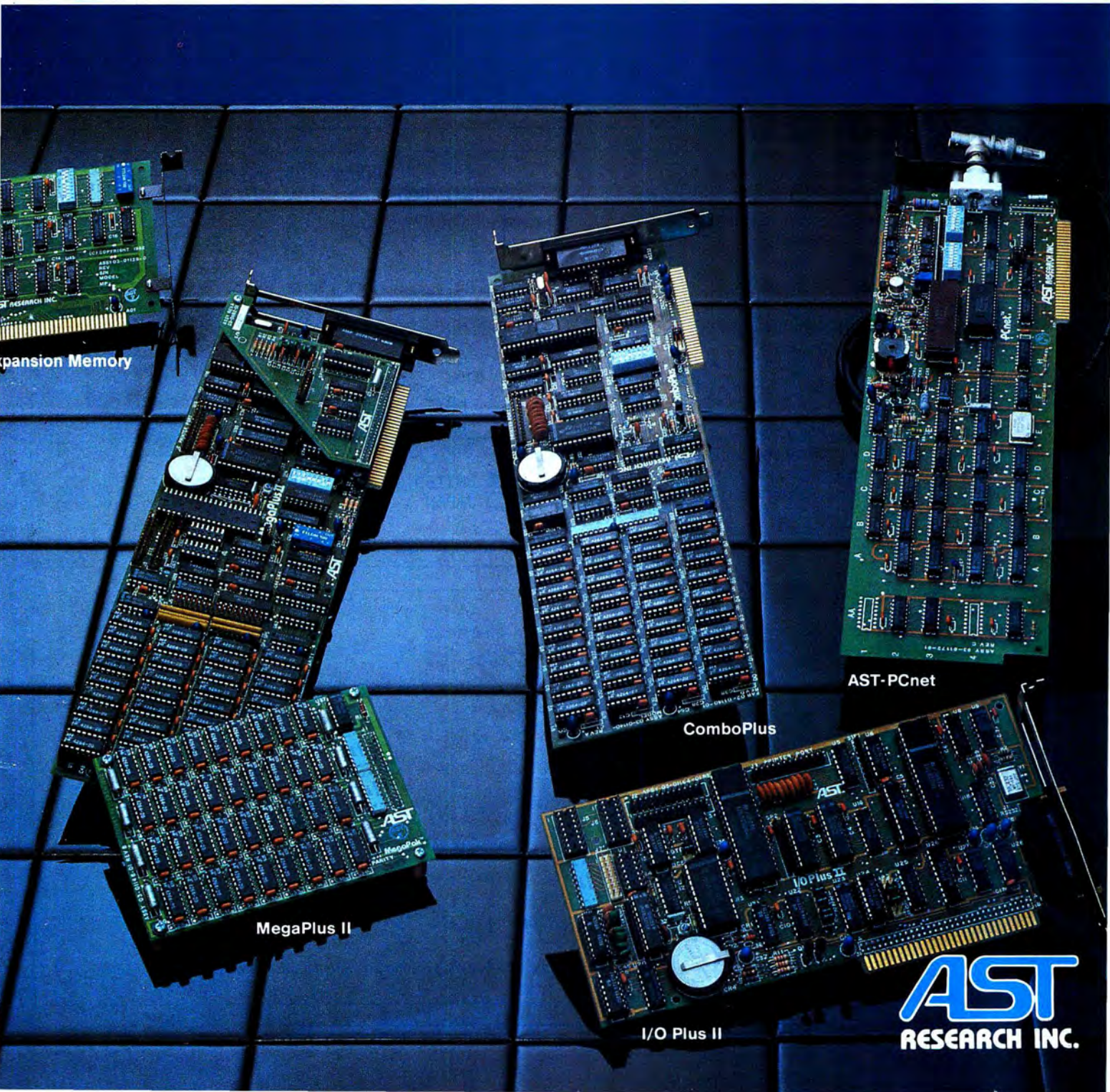

nications program for the pc—offers extensive black-and-white analytic graphics capabilities that can be output to a variety of peripherals. Similarly, specialized programs exist for text-charting and sign-making. And many combination programs, such as *Graph'n'Calc* and *GraphMagic*, have graphics components.

Additional programs that could have been included are *T/Maker III*'s bar-graphing facility for *T/Maker* tables, Ashton-Tate's *Bottom Line Strategist* and Eagle Software's *Money Decisions Volume II*, both of which have graphics facilities for their own output. Finally, some programs (*VisiTrend/VisiPlot* and *MetaGraph*, for instance) were not available for evaluation at the time this review was written.

The first program on our list is *1-2-3*. It is not a graphics program as such, but rather an integrated spreadsheet-database-graphics package. It was used as a benchmark by which to measure the other seven programs. *1-2-3* offers extensive analytic abilities; it allows you to manipulate your data in almost any way you'd like, tabularly, or in a database, before displaying it. Moreover, it has pretty good presentation capabilities; it supports plotter and color printer output, uses different type fonts, allows graph rotation and sizing, and so on.

What makes *1-2-3* a worthy benchmark is the fact that it offers this much capability without being a standalone graphics program. It is reasonable to expect that any dedicated graphics package will offer this much and more for the money.

The detailed comparison of these seven packages is summarized in the table shown on pages 104-105. Before we move to a discussion of the table, however, we need to say a little about what kinds of user these programs are designed for—and about business graphics in general.

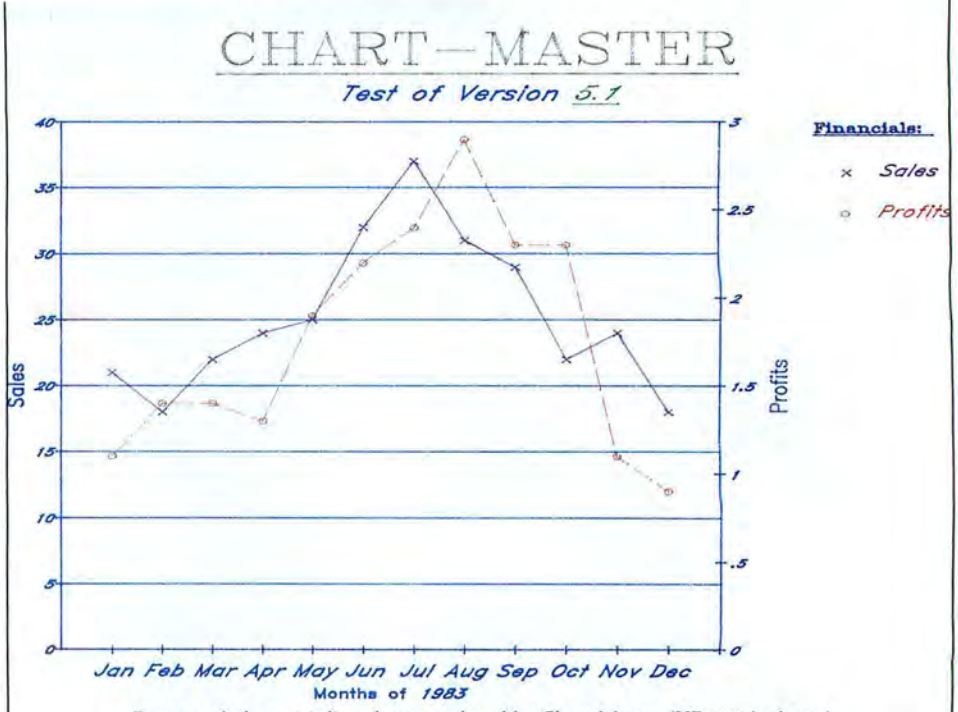

Figure 1. A three-axis line chart, produced by Chart-Master *(HP7470A plotter).*

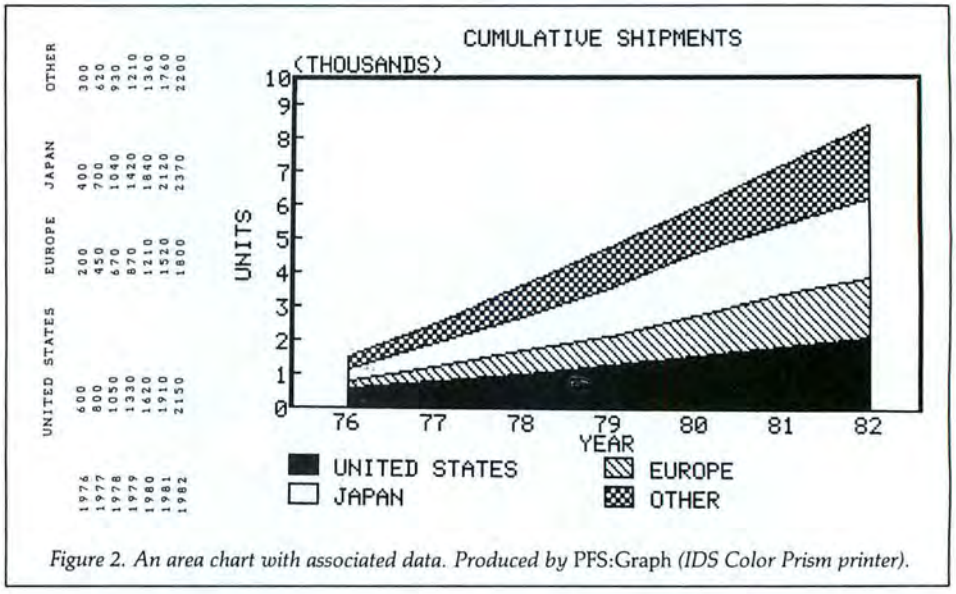

Figure 2. An area chart with associated data. Produced by PFS:Graph *(IDS Color Prism printer).*

THE IDEAL USER AND IDEAL USE.

Throughout this review we're assuming that the primary use of business graphics packages is some kind of analysis and that a strong concern with presentation exists as well. In the perfect world, then, the user would wish to have one program that analyzed all data and provided perfect presentation-quality copies of it in addition to rough analytic versions. Since the world is not perfect, however, and since users often have other programs available (such as *VisiCalc*) that allow extensive data analysis, what's missing most often from the user's software kit is a way to present data in a quality fashion. In ad-

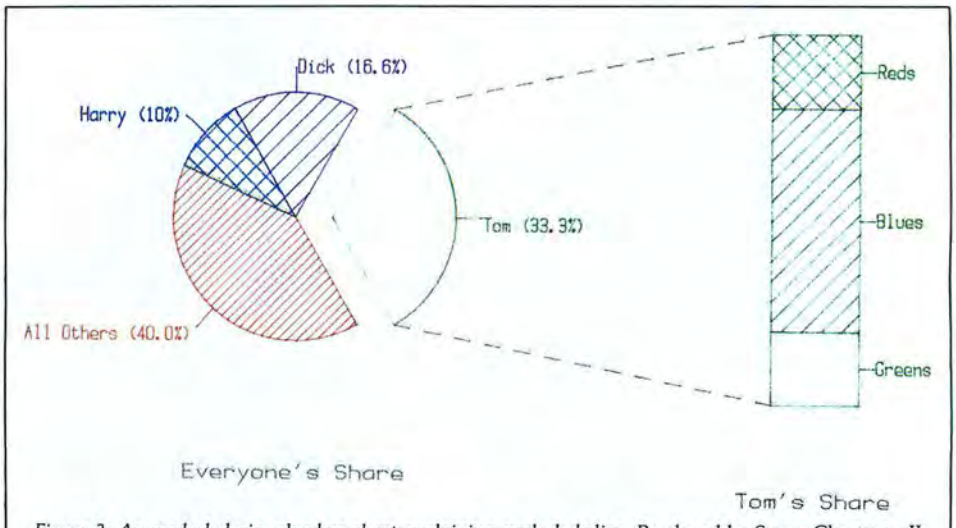

Figure 3. An exploded pie, plus bar chart explaining exploded slice. Produced by Super-Chartman II *(HP plotter).*

dition, different users have different needs. Some want to be able to write extensive text to accompany their graphs, some are interested only in a way to make useful analyses of databases already established, and some others don't care about such specialized applications but have a need for the best all-around package they can get within their budget and existing software library constraints.

This review supposes three ideal users: the manager, the staff support person, and the hobbyist. Good managers want both analysis and presentation graphics. They want it now and they want it simple, so they won't have to spend an hour with the manual every time they need a picture. If they have to choose, however, managers will err on the side of presentation quality, since they know that not only what you say but how you say it is important. Staff support folks may be more tolerant of program complexity but more demanding of analytical excellence (since they are often the ones doing the analysis). Hobbyists are probably more like managers than like support staff but need presentation quality less than either. Their needs are the most variable.

SOME EXAMPLES OF BUSINESS GRAPHICS.

It can be said that graphics concerns transforming numbers into pictures and that the essential ways of doing this are with line, bar, and pie graphs. But this statement is not accurate.

For one thing, the user's concern is not always only with numbers. Often the need is to present text in some pleasing or impressive way. Such text charts or signs draw upon a package's lettering capabilities (called "fonts"). Somewhere between simple signs and purely numerical charts is the "text table" or "matrix." Let's say you have two markets, north and south, and you wish to show something simple about your sales in each—such as whether they're high or low. A graphics package ought to be able to create a simple two-by-two matrix with Region on the left and Sales at the top, label the resulting four boxes High/Low High/Low, and incorporate whatever explanatory text you need inside.

When numbers *are* a concern, the basic graphic types—line, bar, and pie—are important. But these "pure" types may, in some cases, need to be modified in order to achieve the most informative presentation of data. For instance figure 1 shows a three-axis line chart (offered by only a few graphics packages) that allows you to show sales and profits on the same graph. Area charts, which are filled-in "stacked" line charts, are also commonly used (see figure 2). Figure 4 shows only one of the many varieties of bar chart that the users we've designated will need regularly. Other needed bar graph types (besides the simple stacked bar chart) include the clustered bar chart, the horizontal bar chart, and the bar chart that shows negative values as well as positive ones. And, as figure 3 shows, pie charts can get very fancy indeed. The figure shows a "pie-bar" or "exploded" pie chart.

Other important kinds of graphs, entirely distinct from the basic bar, pie, and line types, are the scatter chart (an x-y number chart in which both axes reference continuous numbers but no lines are drawn between the points) and the high/low/close chart for tracking stock prices. Even more advanced charting needs would include the ability to construct organizational charts and PERT (activity) charts that show the flow of activities in a project.

DEFINING YOUR NEEDS.

Clearly what you need a package to do will determine what program you'll want to own. So will your hardware, of course. At the minimum, most of the packages reviewed here require a pc with two double-sided drives and some form of graphics-capable printer, such as the Epson MX-80 with Graftrax. To get close to presentation quality, replace that Epson with an IDS Color Prism printer. True presentation quality requires going all the way to a plotter. When you add in a serial card to run the plotter, the color board and monitor for previewing your graphs, and other optional goodies, it is terrifically easy to invest five to six thousand dollars in a good graphics system.

EVALUATING WHAT THERE IS.

It's easy to get lost in the complicated graphics jungle. It is even easier to get a three-hundred- to five-hundred-dollar software investment home and find out that you don't have the peripherals to run it or, worse yet, that you do but that the program won't work with your system configuration. And it's incredibly easy to have investigated all these things and then learn that a program won't do what you want it to or won't do it in the time you're willing to spend.

You must decide what you need business graphics for—if indeed you need it at all. Whether your primary application is presentation or analysis and whether a package is useless to you without organization charting abilities are also questions you must answer.

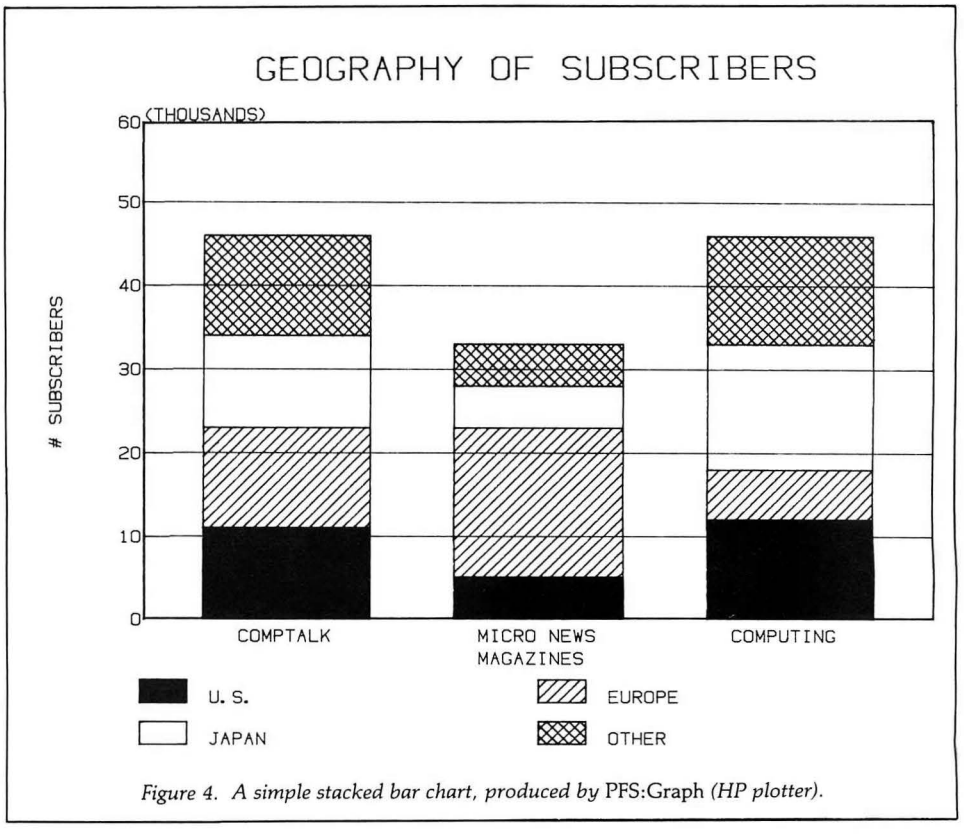

Figure 4. A simple stacked bar chart, produced by PFS:Graph *(HP plotter).*

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Once you know these things, though, there is much you can do to reduce your graphics risk.

The first thing you can do is examine the table on pages 104-105. It provides a comparison guide to the seven standalone packages under review in this article. Sorry about the complexity of this table, but it *was* necessary. If, for example, all your data files are on *SuperCalc*, the fact that a program won't read *SC* files makes it something less than useless to you.

THE TABLE EXPLAINED.

Let's walk through the table item by item. There are nine major headings. The first two, *requirements* and *peripherals supported*, tell you what you need to use the package and what peripherals you can use with it. The next three, *package*, *performance*, and *limitations/special features*, tell you about the software as you'll receive it, about how you get data into it, and about some things the package will and won't do that you'll never learn from the outside of the box or from your dealer. The next two sections, *basic features* and *advanced features*, tell you what the package is capable of producing and how it does it. The last two headings, *usefulness* and *comments*, contain subjective quality ratings and some other remarks.

To get an idea of what's going on in the table, start by looking at the entries under *1-2-3*. The *requirements* category shows the release number of the package evaluated and how much memory you'll need to run the program. Next, the machines and operating systems needed are listed. A *Y* here means that the program does run with the system in question.

The table also answers the following questions: Does the program support a non-RGB color system (*1-2-3* doesn't)? Does it run (but not graph) on the mono screen? And does it support RGB graphics? If two answers to these three questions are yes, does the program show the data or other output on the mono screen while simultaneously showing your pictures on the color screen?

Looking now at the disks entry, can you get by with single-sided disks or do you need double-sided? Does the program run on a hard disk?

Now to *peripherals supported*. This section is straightforward, with a few exceptions. Some graphics packages work with a given peripheral only if the peripheral is hooked up to the pc in a certain way. *Super Chartman II*, for example, works with the IDS Prism, but only if you have the printer connected by means of a parallel cable (this is one of those things the ads don't tell you).

Package tells you whether the system disk is copy-protected and whether the vendor supplies a backup. This section also offers a subjective rating of the manual and tells you whether a tutorial is included either in the manual or via example files on disk.

In terms of *performance*, all of these systems accept data from the keyboard, but many offer no way of getting files you have already created with a different software package, such as *Multiplan*, into your new graphics program. Support of the Software Arts DIF file format is near universal in the systems reviewed here, which means that *VisiCalc* and *1-2-3* files can be used with many of the packages listed. Note that some packages can't use these files and that many don't work with *SuperCalc* or *Multiplan* files.

Limitations/special features tells you the limits of what the software package will accept. *1-2-3*, for instance, doesn't let you have more than six data sets per graph. That means six sets of lines or six sets of bars is a practical limit on *1-2-3*'s abilities. Of course, each line or bar can be comprised of many points, unless otherwise limited by the software. Read this section with care: Some manufacturers are good about discussing their packages' limitations and some are not. We made an effort to test each package and verify what it could and could not do, but nobody catches everything.

The *basic features* and *advanced features* rows are mostly self-explanatory. *Basic features* lists the kinds of graphs that can be generated and indicates whether the package lets you produce signs or overhead acetate transparencies. *Advanced features* tells whether the program allows you to compute and display statistics on your data or graph; whether explicit provision is made to compute and display a least-squares regression line; whether you can use the package for forecasting with exponential smoothing, power curve generation, and other curve-fitting; and whether the program offers the facility to let you transform data by adding some number to all your entries, by converting the entries to percentages, or by some other means.

Also under *advanced features*, the table tells you how titles and legends may be manipulated. For instance, does the program do auto-scaling of data values, and can you override this if you wish? Can you convert from linear to logarithmic scaling to better display numeric trends? How many lines (and characters) can the top, bottom, left, and right heading spaces accept? Does the package allow a footnote space at the bottom of the graph? And does it scroll horizontally, vertically, or both?

Hang in there. We're not through yet. Does the program label bars and points automatically, with labels of your own choosing that already exist somewhere within a spreadsheet file? Or do you have to enter these manually? Or are they entirely unavailable? Can you have a "floating legend" pointing to some feature of interest on your graph? How many distinct lettering types (fonts) does the program provide? And how many sizes of graph can it produce?

Turning to the *output* subsection of *advanced features*, are color choices governed by the program, selected manually, or both? Does the program take advantage of the pc's higher-resolution black-and-white graphics capability? Can you put multiple charts on the same page automatically? Manually? Can you control size, rotation, print density, and page position of your graphs?

Finally, how quick is the program at screen display and printing/plotting? Can you abort the output once it has begun? Is there a way to preview what's going to come out on the output device? And can you get a disk directory whenever you want one?

Now we come to the nitty-gritty. Just how useful is the package to managers, to support staff, and to hobbyists? And how much value for the money does it give you?

SEVEN GRAPHICS PACKAGES.

Having now covered the organization of the table let's move on to some descriptive comments about each of the programs.

Super Chartman II. Super Chartman II is a fine program. It generates line, bar, pie, and text charts on a number of the more popular plotters and printers. The program works as advertised (be sure to get *Super Chartman II*, not *Chartman II*). It's a fine piece of software execution, notwithstanding its failure to use both screens for simultaneous text and graphics display. There are three separate disks—one for bar charts, one for pie charts, and a third for line charts and text charts—so plan to do a lot of switching, unless you have an XT or know pretty clearly how you want your data to look. The software is locked by means of a "key disk."

The *Super Chartman II* manual is nice and even includes graphics request forms for office use. It's hard to find flaws in this newest version of *SC*. Most of the little tooth-grinders in the previous version have been corrected, and the program does its work well, quickly, and professionally.

BPS Business Graphics. This package is complicated, uses a non-DOS operating sys-

tem, and is hard to learn. If you fight with it until you can use it, however, it will reward you with an array of analysis options and display formats not available on many other systems—and it works with a large variety of peripherals.

BPS is not menu-driven. Instead, you "talk" to the program by means of a graphics language, using commands such as *set console to rgb* and *draw axes*. For the most part, these commands are understandable and sensible; but there are a lot of them, as befits a complicated graphics package, and this makes learning slow. You're also likely to forget much of what you know if you take a month's vacation from the package.

Some oddities of *BPS* deserve mention. The program makes a distinction between devices that have low resolution (such as screens and dot-matrix printers) and devices that allow more precise placement of graphics characters (such as plotters). It forces you to learn which is which and to change your command vocabulary, depending on the type of device you wish to communicate with. The distinction seems unnecessary; it was probably made because *BPS* supports more peripherals than you'd care to shake a stick at. (If you have a Watanabe plotter, for example, this program can drive it.)

BPS also allows you to generate what are called "take" files—prespecified sets of graphics commands that can be used for a number of purposes, including a slide show.

BPS offers some repayment for the hassle of using a non-DOS operating system. The program includes a translation module, which translates DOS files to p-System, and it accepts p-System text files directly. *BPS* has advanced

A COMPARISON OF SOME IBM PC GRAPHICS PACKAGES

CHARACTERISTIC	Benchmark: 1-2-3	Super-Chartman II	BPS Business Graphics	Chart-Master	Graphwriter	Fast Graphs	dGraph	PFS: Graph
Requirements:								
Memory								
64K						Release 1.10	Release 1.0	Release 1.0
128K			Release 1.0	Release 5.0	Release 3.1			
192K	Release 1A	Release 1.0						
256K								
Machine/DOS								
PC	Y	Y	Y	Y	Y	Y	Y	Y
XT	Y	Y	Y	Y	Y	—	Y	Y
1.1	Y	Y	—	Y	—	Y	Y	Y
2.0	Y	no trees	—	no trees	no trees(?)	—	no trees	no trees
Pascal	—	—	Y	—	Y	—	—	—
Monitor								
Color	—	—	Y	Y	Y	Y	Y	Y
Mono	Y	Y	Y	Y	Y	Y	—	Y
RGB	Y	Y	Y	Y	Y	Y	Y	Y
Both Simul.	Y	—	Sort of	Y	Y	—	—	—
Disks								
Single	—	1 or	2 or	2 or	—	2 or	—	1
Double	2	1	2	2	2	2	1	1
Hard	Y	with XT	—	Y	XT	—	Y	Y
Peripherals Supported:								
Printer								
Epson	Y	Parallel only	Y	—	any to dump	Y	Y	Y
IBM/G	Y	Parallel only	Y	—	data; not	—	Y	Y
IDS	Y	Parallel only	Y	—	for	Y	Y	no color
Anadex	Y	—	Y	—	pictures.	—	Y	—
Itoh	Y	—	Y	—	—	—	Y	Y
NEC	Y	—	Y	—	—	—	Y	Y
Others	Y		Many	—	—	Y	Y	Y
Plotter								
HP	Y	Serial only	Y	Serial only	Y	Y	—	Y
IBM		Serial only	Y	Serial only	Y	—	—	—
Others	Y	—	Many	Many	Y	Y	—	Y
Package:								
Characteristics								
Protected	Y	Y	—	Y	—	—	—	Y
Backup	Y	—	Y	—	—	—	—	Y
Manual	Excellent	V. Good	Adequate	V. Good	Good	V. Good	Good	Excellent
Tutorial	Book/Disk	Book	Book/Disk	Book	Book	Book/Disk	Book/Disk	Book/Disk
Online Help	Y	Y	Y	—	Y	Y	Sort of	—
Operation	Menu	Menu	Language	Menu	Menu	Menu	Menu	Menu
Price								
Performance:								
Data Entry								
Keyboard	Y	Y	Y	Y	Y	Y	Y	Y
Files								
ASCII	w/Import	—	DOS or p-Sys	—	—	—	Y	—
DIF	Y	Y	—	Y	Y	Y	—	Y
Multiplan	—	—	—	—	—	Y	—	—
1-2-3	w/DIF	w/DIF	—	w/DIF	w/DIF	w/DIF	—	w/DIF
S/Calc	—	—	—	—	—	Y	—	—
Oth. Calc	—	—	—	—	—	Y	—	—
DBMS	dBASE II	—	—	—	—	—	dBASE II	PFS:File

CHARACTERISTIC	Benchmark: 1-2-3	Super-Chartman II	BPS Business Graphics	Chart-Master	Graphwriter	Fast Graphs	dGraph	PFS: Graph
Limitations/ Special Features:	6 data sets	60 pts./line 8 digit labels 20 slices/pie 70 chars-text 40 lines-text Slide Show	11 digit labels skips obs if necessary	52 labels skips obs if necessary	4 pies/page 36 bars/grf 8 segments/ba 20 chars/leg. 100 pts/line 16 slices/pie	72 bars 12 pie slices 6 sets data/ln Slide Show	52 rows, 4 col Autograph Zoom dBASE math	Auto dates 4 bar clusters 15 char labels 36 pts. line 144 pts./graph 16 labels/grph
Basic Features:								
Type								
Line Chrt	Y	Y	Y	Y	Y	Y	Y	Y
X-Y	Y	—	Y	—	Y	Y	—	Y
Text/Text	—	—	Y	—	Y	—	—	—
Area Ch.	—	—	Y	Y	Extension Set	—	—	Y
V. Bar	Y	Y	Y	Y	Y	Y	Y	Y
H. Bar	—	Y	Y	Y	Y	Y	—	—
3-D Bar	—	Y	—	—	—	Y	—	—
Stack B.	Y	Y	Y	Y	Y	Y	Y	Y
Line/Bar	—	Y	Y	—	Y	Overlay only	—	Y
Clus. Bar	Y	Y	Y	Y	Y	Y	Y	Y
Neg. Bar	Y	Y	Y	Y	Y	Y	Y	Y
Pie	Y	Y	Y	Y	Y	—	Y	Y
Exp. Pie	—	Y	—	Y	Y	Y	Y	—
Pie-Bar	—	Y	—	Y	Y	Y	Y	—
Scatter	Y	—	Y	Y	Y	Y	—	—
3-axis	—	Y	—	Y	Y	—	—	—
Signs	—	Y	—	Optional	Y	Graphics Edtr.	—	—
Transpar.	—	Y	Y	Y	Y	—	—	Y
Others?	—	—	—	Hi/Lo/Close	Extension Set	PERT chart	—	—
Advanced Features:								
Stats	Spreadsht	—	Y	—	—	—	avg, oth.	cum.
Regress	—	—	Y	Y	Y	Y	on dBase	—
Forecast	Manual	—	Y	Y	Y	—	—	—
Transform	Spreadsht	—	Y	—	—	—	Y	—
Tit./Legends								
Auto Scal	Y	Y	Y	Y	Y	Y	Y	Y
Manual	Y	Y	Y	Y	Y	Y	Y	Y
Log Scale		Y	Y	Y	Y	—	—	—
Multi-line								
.Top,	2 (39c)	3 (48c)	1 (40c)	4 (50c)	3	1	1	1
.X-Axis	1 (39c)	1	1	2	1	1	1	1
.Y axis	1 (39c)	1	1	2	1	1	1	1
.Right	—	1	1	2	—	—	—	—
.Ftnote.	—	3	—	1	3	—	—	—
Grid	H,V,B	H,V,B	H,V,B dash	H,V,B dash	H,V,B dash	H,V,B	H	H
Data Labl	Y	Y	Y	Y	Y	—	—	—
Auto Labl	Semi-	Man. only	Y	Semi-	Y	—	—	—
Float leg	No	—	Many	Y	Y	Graphcs. Edtr.	—	—
Fonts	8	4	In Periph. Onl	6	6	—	—	1
Sizes	Auto (3)	8	2	16	Many	—	—	2
Output								
Colors	Auto+Man	Manual	Auto+Man	Manual	Auto+Man	Auto	B+W only	B+W print;man
Hi-Res	Y	Y	Y	Y	Y	—	Y	—
Mult Chrt								
. Man	Y	Y	—	Y	Y	—	—	—
.Auto	Semi-	—	—	Y	Y	—	Y	—
How Big?	Y	Y	—	Y	Y	3 sizes	—	—
Rotation?	Y	—	—	Y	Y	—	—	—
Compress.	Y	Y	—	—	Not needed	—	—	—
Location?	Y	Y	—	Y	Y	—	—	—
Speed?	Fast	Moderate	Slow	Moderate	Mod. Slow	Slow	Moderate	Fast
Abort?	Y	Y	Y	Y	Y	Y	Y	Y
Preview?	Y	Y	Y	Y	Y	Y	Y	Y
Directory	Y	From menu	Y	Y	—	Y	—	Y
Usefulness:								
To Managers (1-5)	5	4	3	4	4-	2	2	3+
To Support Staff	5	5	4	4	5	3	2	3
To Hobbyists	5	4	3	4	3+	4	4	4
Overall Value/$	5	4+	3+	4	4	3	3-	4-
Comments:	The one to beat!	Very nice; periph. restr. unnecess.	Very complete but complex Unnec. restrict.	Easy, quick, good. No printers.	Slow, but awesome quality	Competent.	If only dBase a concern, then all 5s	Very useful *with* PFS; otherwise, adequate.

analysis features—for curve fitting, generating and plotting a frequency distribution, and other options—that rival those of the finest spreadsheets. It is the only one of the programs under review here that can be made to generate a two-by-two or three-by-three text matrix.

In other areas, however, it takes back what it gives. To get a clustered bar chart with four sets of bars, for example, you must enter, save, and load four different sets of data.

A backup disk is provided free when you send in your warranty form.

Chart-Master. In many ways, *Chart-Master* is among the easiest to use and most flexible of the packages reviewed here. All of its choices—and it offers almost as many as *Chartman*—are clearly explained through on-screen menus. The program offers the most text sizes of any of the packages available (except for *Graphwriter*), does its job on both screens, and is directed squarely at the upper end of presentation graphics (it supports plotters only—no printers).

Although *Chart-Master* includes area graphs and high/low/close charts, it does not offer some of the more common chart types, such as simple x-y graphs (the x axis on *Chart-Master* must be a label or time series of some sort). Also, the original *Chart-Master* had sign-generating capabilities, which are not provided in the current version (but the menu doesn't tell you that). These capabilities have been split out as a separately sold program called *Sign-Master.*

Chart-Master is quick, does its job well, and offers lots of features.

Graphwriter. Graphwriter is certainly the most unusual and the most presentationally directed of the programs reviewed. *Graphwriter* will very nearly run itself, if you like, making effective and esthetically pleasing choices with regard to color, size, and other parameters. If the other programs can be thought of as very good microcomputer-designed packages, then the way to think of *Graphwriter* is as a mainframe-level package that has somehow been shoehorned into a microcomputer.

GW understands English. Want to use a gold pen? Type *gold.* Want your headings in bold italic? Type *bold italic.* The program is run from a nest of clear menus and provides one of the best on-line help facilities of all the programs looked at.

The program is so complex and detailed that it has three (count 'em three) reference guides. Examples of *Graphwriter*'s output are provided in figures 5 and 6. Figure 5 is what passes for a plain vanilla bar chart in *GW*; note how fancy it is. Figure 6 is figure 5 spiffed up with bold italics and a frame and reduced to plot on only the left side of the page, so that the user can write on the right.

The program comes with the "basic graphics set" shown under *basic features* in our comparison table. Soon you'll be able to buy an extension set that leaves no line on our table unfilled and that makes graphs (such as growth/share matrixes) that no program but the unreleased *Chartman IV* has attempted on a micro before.

So we should all run out and buy this package, right? Well, not so fast. The program won't output to a printer (an IDS Prism support package is rumored); it supports only plotters. *GW* buys you an awesome amount of presentational quality (and a bit of artistic consulting advice as well) that will make you look like a star. But you pay, you pay. And not only in the out-the-door price, either.

First, the program runs in Pascal, which limits its usefulness for many data files you may have already generated. This is a serious shortcoming for a presentation graphics program, which depends on other programs for its usefulness. Fortunately, you get a program that can read either DOS or p-System DIF files into *GW.* But the fact remains: You'll be using two operating systems unless you're a Pascal user.

Second, because it's so complete, this software is slow. The new release (version 3.1) represents something like a 400 percent improvement over the initial release of the software—a major breakthrough. But whether it will be fast enough for your needs or just try your patience even in the fast new release is a matter of conjecture. Delays are longer here than in the other packages reviewed, but certainly not intolerable (under one minute to boot, about twenty to thirty seconds for switching from bar to pie graph formats, for instance). For $500, though, get *GW* demonstrated before you buy. It does a good deal more than the other packages a good deal better than they a good deal slower.

Fast Graphs. The Innovative Software people have a reputation for making Basic do everything but windows, and they've lived up to this reputation again with *Fast Graphs.* What other program interfaces with almost everything, works with many of the more popular printers and even with plotters, and offers many basic graph types as well as a form of PERT charting? As if that weren't enough, the program also includes a slide-show feature for organized screen displays and a complete graphics editor for adding arrows, logos, and text to your graphs.

Including the graphics editor and its abilities in the program meant that the *FG* had to make a clearer choice than is evident in many other packages between analysis and presentation quality graphics. Clearly, there is no good way to gin up a set of fonts that will reproduce specialized logos or drawings—you just dump the screen for that and live with the resolution limits that doing so imposes on the printers and plotters involved. That's the choice the *FG* people made, and it makes this system unsatisfactory for presentation purposes.

Figure 7 shows a dump to an IDS Prism, which is capable of much more resolution than you see in the figure. The problem is even worse if a plotter is used. In fairness, the *FG* people have just come out with another package (unavailable when this review was written) that does include a fonts facility and other features for presentation quality graphics.

In all other respects, if you can live with the repetitive disk accesses that chained Basic programs entail, *FG* is an outstanding program. Be sure to check the new version when it becomes available and remember that the ratings in our table are based on the old.

dGraph and *PFS:Graph.* A new genre of software has come on the pc scene recently: the graphics query system for a popular database program. A graphics query system is just that: You ask the database a question and it draws you a line, bar, pie, or other chart that tells you the answer. The possibilities are awe-inspiring.

Two such programs, *dGraph* and *PFS: Graph,* were included in this review because they are examples of this new ilk and because in addition to offering graphics query capabilities they also claim to be standalone graphics packages.

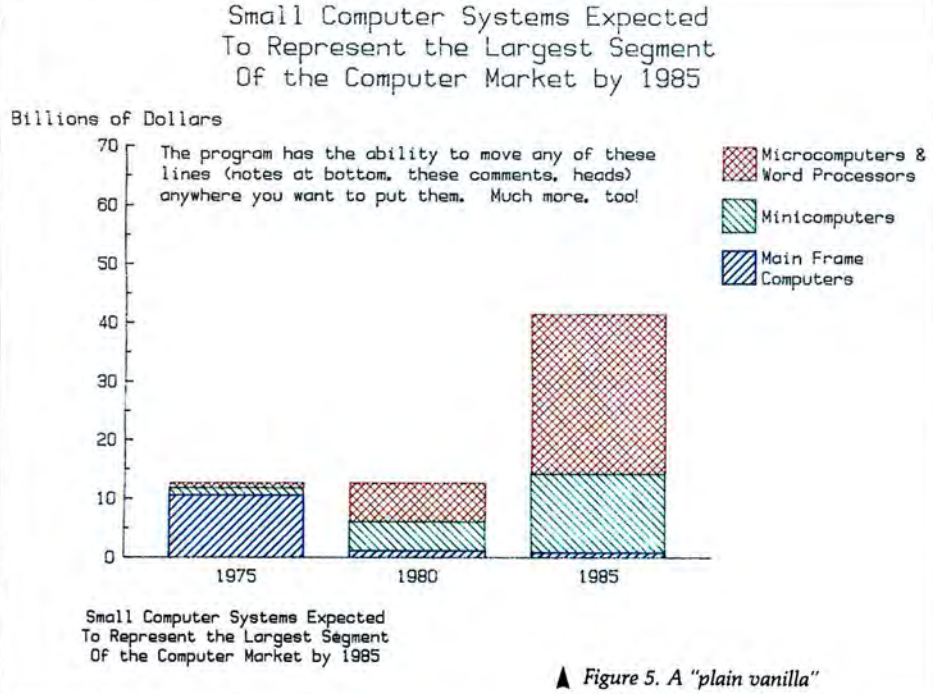
Despite that claim, it is in some ways unfair to evaluate these two programs as standalone graphics packages. Both of these programs are top-flight graphics query generators, but without their unique querying capabilities they just wouldn't measure up against the other packages reviewed here.

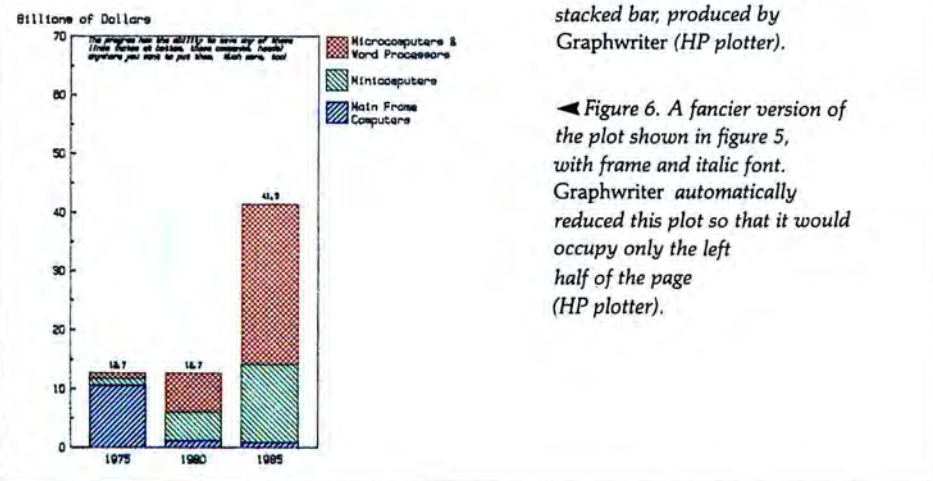
dG works only in black and white (regular or inverse), does not deliver presentation quality graphics, has restricted graph types (although it does offer some neat features, such as exploded pie charts), and just doesn't stack up to what else is out there. But just give a user *dBase II* and this little system and he can cook. This one program won't meet all your needs if you have other graphics applications, but if *dBase II* is one of your mainstays, you won't want to be without it.

The *PFS* people package their stuff in a box more suitable for Hallmark cards than for software, write thin little manuals, and leave you wondering just why you parted with your good money. Then you boot the software and read the manual and—wow! Competence with clarity.

PFS:G is no exception. It's a most useful program that accepts data directly from *PFS :File* databases and serves as a graphics query system into that application program. It is also a competent but limited standalone package that shows more blank spaces than filled-in capabilities on our comparison table.

The bottom line on both of these "new-wave" software packages is that if your primary need is to delve graphically into the





▲ *Figure 5. A "plain vanilla" stacked bar, produced by* Graphwriter *(HP plotter).*

◄ *Figure 6. A fancier version of the plot shown in figure 5, with frame and italic font.* Graphwriter *automatically reduced this plot so that it would occupy only the left half of the page (HP plotter).*

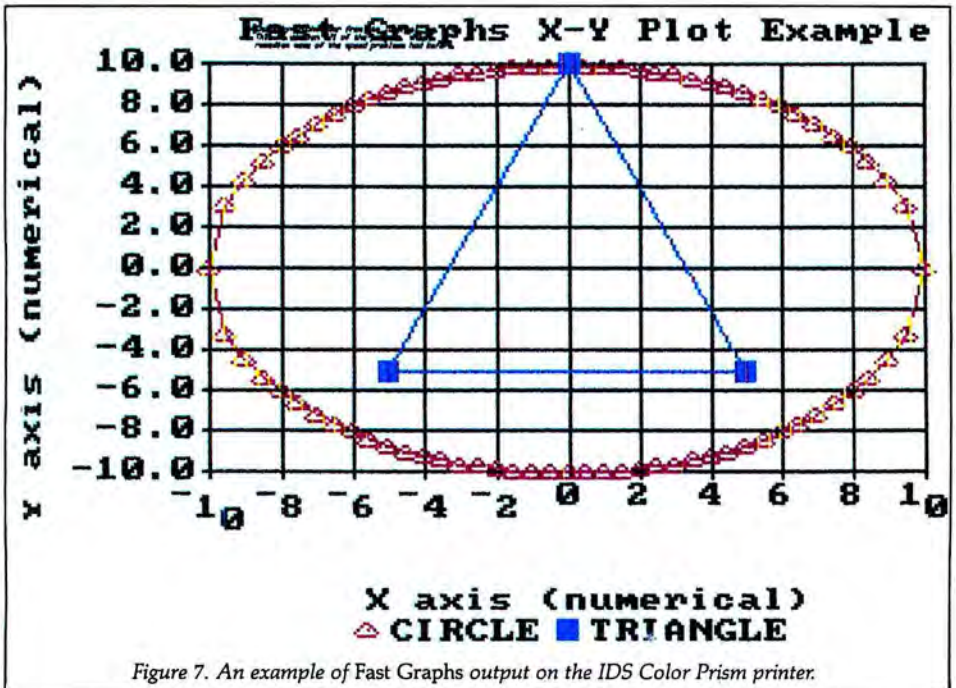


Figure 7. An example of Fast Graphs *output on the IDS Color Prism printer.*

database management system they support (*PFS:Graph* also lets you incorporate pictures into *PFS:Write*), buy them. But if you need a broader array of charting capabilities or you don't use these databases, one of the more general programs may be better for you.

WRAPPING IT UP.

So, which package should you buy? If you can have only one package, you may do better with *1-2-3* than with many others. If you need the capabilities of a dedicated graphing package, then *Super Chartman II* and *Chart Master* would make the "short list" to see demonstrated before purchase. If presentation quality (with the flexibility of English-like commands) is your criterion, *Graphwriter* and *BPS Business Graphics* are candidates. If you do lots of graphics editing—adding logos to charts and the like—look closely at *Fast Graphs* and also at *MetaGraph* and *PC-Draw* (not reviewed here). And if database management is a primary application and graphics query a secondary one, the two "new-wave" programs may hold the key.

1-2-3 $495
Lotus Development Corporation
55 Wheeler Street
Cambridge, MA 01238
617-492-7171
Super Chartman II $425
Graphics Software, Inc.
1972 Massachusetts Avenue
Cambridge, MA 02138
617-491-2434
BPS Business Graphics $350
Business and Professional Software
143 Binney Street
Cambridge, MA 02142
617-491-3377
Chartmaster $375
Decision Resources, Inc.
Box 309
Westport, CT 06881
203-222-1974
Graphwriter
Basic package, $395;
Extension package, $395; both, $595
Graphic Communications, Inc.
200 Fifth Avenue
Waltham, MA 02254
617-890-8778
Fast Graphs $350
Innovative Software, Inc.
9300 West 110th Street
Overland Park, KS 66210
913-383-1089
dGraph $295
Fox and Geller
604 Market Street
Elmwood Park, NJ 07407
201-794-8883
PFS:Graph $140
Software Publishing Corporation
1901 Landings Drive
Mountain View, CA 94043
415-962-8910

▲

A REVIEW OF FIVE PLOTTERS
BY MICHAEL COOPER

DRAWING THE LINE

Once you've made the decision to use your pc to create graphics, you have a second decision to make: How will you communicate the results to others?

Most graphics software products provide for on-screen preview of your work. This capability should satisfy your viewing needs during analytical work sessions and should suffice when you're doing work for personal use. But when your objective is a broader dissemination of graphic information, additional hardware must be incorporated into your configuration and new choices must be made.

Graphic output devices generally fall into one of three categories: plotters, graphic printers, and cameras. Of the three, plotters are the most versatile. They can produce output in multiple colors on multiple media in multiple sizes. Their output is generally of such high resolution and quality that they can be used to produce camera-ready artwork when 35mm or larger format slides are required.

In this article we'll review five plotters available for the IBM Personal Computer: the Calcomp M84, the IBM X/Y 749, the Hewlett-Packard 7470, and the DMP 40 and DMP 29 from Houston Instruments.

Things To Consider When Choosing a Plotter

Business graphics are generated in an office environment and are used to analyze data and spot trends. They also appear in reports and memoranda that are distributed both internally and externally. Finally, they are used in presentations and review sessions. Each of these uses demands a unique set of functional conditions. Making the right choice of plotter requires that you define a set of evaluation criteria that apply to your intended use.

Plot Size. Plotters are categorized by the maximum drawing size they can produce. "A" size plotters have a maximum drawing size of eight inches by ten inches. "B" size plotters can produce eleven-by-seventeen-inch drawings. Plotters range upward in size to "E" size, which has a maximum of thirty-four inches by forty-four inches. Drawing-size standards are set by the American National Standards Institute (ANSI) and are adhered to by most professions that rely on two-dimensional and three-dimensional drawings as standard ways of communicating. The plotters reviewed here are either "A" size or "B" size ("B" size plotters can also produce "A" size drawings).

Plot size may be viewed as one of several characteristics that affect price. Some additional matters to consider are number of pens that may be accessed without operator intervention, environmental factors (such as the amount of noise produced by a plotter), plotting speed, and whether the paper moves or is stationary (see the accompanying article, which explains more about how plotters work).

Number of Pens. If you'll be using a plotter in an office environment, perhaps the most important factor in your decision will be the

number of pens the plotter supports without operator intervention. This number is generally a function of price, although at present the capability to use more than two pens without operator intervention is available only in x-y models.

Why is this important? A typical business graph takes from three to ten minutes of plotter time. If pen changes are required (for multiple-color plots), plotting time increases, as does the time required from an operator. Even if that operator isn't earning an executive's hourly rate, you can quickly eat up whatever you might have saved by buying a single- or double-pen plotter. Clearly, frequency of use needs to be considered as well.

Besides requiring additional operator time, changing pens by hand can affect the number of times a plot must be attempted before a satisfactory result is achieved. The operator must place the pens in their holding stalls in precisely the right position in order to avoid having the pen holder fail to pick up the pen and go off plotting with no pen in the pen holder; when this happens, the operator generally has to restart the plot from the beginning on a new piece of paper.

Business graphics presentations require the capability to plot on Mylar or acetate, as well as on paper. Presentation slides also mandate the use of multiple solid colors for maximum visual impact; fill patterns are effective in reports or when copied using a monochrome copier but are much harder to interpret when projected. A good rule of thumb for estimating the number of pens a particular chart requires is to count one for the axis and border, one for each variable to be plotted, and an additional pen for any emphasis the titles require. In other words, a three-variable plot with contrasting emphasis color in the title and notes would require five pens. If a two-pen plotter were used with the first two colors loaded before the plot is started, completing the plot would require three pen changes.

Pen Quality. The pens themselves significantly affect the appearance of plotted output. Top-quality overhead transparencies require a variety of saturated colors. Filling in bars and pie segments with color calls for wide-tipped pens. If line or scatter charts are used, fine tips may be a requirement.

Pen Price. Pens are the consumables in the world of plotters. Long after the purchase price of the plotter has been fully depreciated, pens will still be an expense. The life expectancy of a pen is directly related to the care it receives (is it capped securely?), its type (paper versus transparency), and how frequently it is used. It's not uncommon for a tightly and infrequently used pen to go dry from evaporation. At a price of between three and five dollars per pen, a good selection of paper and transparency pens in a variety of line widths and colors can cost more than one hundred dollars.

Environmental Factors. The office environment dictates size and noise limitations. Paper movers take up less space than x-y plotters do, but they require clear areas in front and in back of them when they are in use (the moving paper may extend as much as a full length behind or in front of the pen housing when plotting is taking place at either extreme of the page). Operating sounds range from the quietness of pen stroking paper to the near racket produced by a pulley and some paper-moving mechanisms.

Speed. Speed ratings can be misleading and are therefore worth discussing. Plotter manufacturers provide linear pen-speed measurements for their products, in either inches or millimeters per second. These ratings reflect a pen's linear speed on paper along either axis. Lines that are not on either axis, stroked characters (as opposed to those generated from ROM by "intelligent" plotters), and curves are produced more slowly when the pen or paper changes direction or when the pen is lifted. Manufacturers generally do not publish the speeds at which these other activities occur.

Business graphs are usually made of many short line segments and also generally contain alphanumeric characters. Plotters of vastly different linear pen speeds may therefore have much more similar completion times for a particular graph than you might expect. Finally, manufacturers of the faster plotters recommend that you slow them down for high-quality work on paper and for all work on transparencies. Therefore rated pen speed may have little or no effect on how fast your graphs are actually produced.

Interfaces. In addition to the factors already discussed, you should also consider interface availability, plotter intelligence, and pen availability. Most generally available software packages interface with plotters by way of a serial (RS-232C) port, although some also work with an eight-bit parallel interface. If you're contemplating doing any scientific or laboratory data graphing, an IEEE 4888 (GPIB) interface may be helpful, since many laboratory instruments use this standard. Several plotter vendors allow you to order any of the three interfaces just mentioned; others can supply only one or two.

Intelligence. The more expensive plotters provide various levels of microprocessor and ROM capacity. These plotters have built-in intelligence that enables them to produce multiple character sets, axes, circles, arcs, fill patterns, and line types—thus reducing the amount of information that has to be sent to them by the computer. These capabilities are nice to have if you're writing your own programs, but many commercial software packages don't take advantage of these features. Instead, they assume that your plotter is capable of only the simplest commands and restrict themselves accordingly.

What this means is that today's crop of intelligent plotters is more capable than currently available software gives them credit for being. Does this imply overkill? Probably not. Speed, line quality, and reliability are all by-products of the intelligence of these plotters, and there is always hope that future versions of existing software packages will include more sophisticated drivers capable of fully using plotter hardware intelligence.

Five Plotters

Hewlett-Packard manufactures a two-pen paper-moving plotter, the 7470. Because of the length of time this product's been out , its moderate price, its retail availability, and the support and reputation of H-P, the 7470 has enjoyed great popularity in business graphics applications. Recently several new plotters of the x-y type have become available at a price close to that of the 7470. Both the IBM X/Y 749 and the Calcomp M84 are "A" size and offer eight pens, relatively fast plotting speed, and wide software support. Lately new interest has been focused on two models available from Houston Instruments, the DMP 29 and the DMP 40. Both these units offer "B" size capability. The

cont'd on page 112

HOW A PLOTTER WORKS

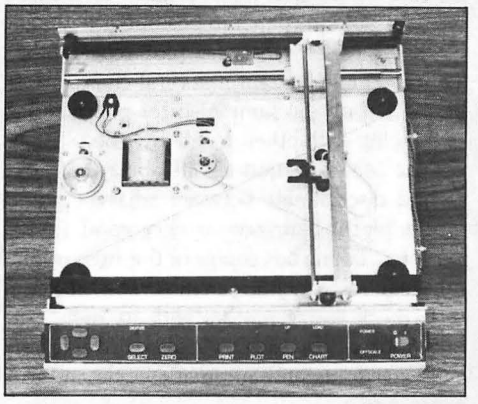
There are several types of plotters available in each of the standard drawing sizes. The simplest type to understand is the flatbed plotter. The name refers to the flat surface on which the paper or other drawing medium is placed. The paper remains stationary, held in place through one of several techniques, with the pen doing all the moving.

In a flatbed plotter, the pen is moved in either the x- or the y-axis direction by one of two motors connected via cables and pulleys, to the pen holder or to the gantry arm. The pen-gripping device is called the pen holder, and the bar on which it moves is called the gantry arm.

The accompanying photograph shows a flatbed plotter with the pen holder clearly visible. The gantry arm cover has been removed to reveal the guide rod on which the pen holder slides and the pulleys that direct the cables that control it.

A flatbed plotter has two specially designed motors. These motors can turn in either direction and are capable of making very fast changes of direction. One motor controls the location of the pen holder on the gantry arm; the other moves the entire gantry assembly over the bed of the plotter.

Drawing a line in either axis direction requires moving the pen in a single direction parallel to that axis. This requires only one motor, and straight lines of this sort are the simplest lines to draw. Straight lines in all directions other than parallel to either axis, as well as all curves, are drawn by turning both motors simultaneously. A straight line positioned at a forty-five-degree angle to the axes is drawn by turning both motors at the same speed at the same time.



A flatbed plotter showing gantry arm, slides, cables, and pulleys.

A plotter's ability to control precisely the speeds of both motors is what determines the straightness of the resulting lines. Imprecise control results in bowed lines.

Varying motor speeds independently allows the drawing of high-resolution curves, circles, and alphanumeric characters. A plotter's resolution, measured in small fractions of an inch, is directly related to its ability to vary motor speed and change rotational direction.

Another type of plotter moves the pen in one direction only while moving the paper, or plotting surface, in the other direction. The combination of motions produces the same effect as is achieved by moving the pen in both axes.

Drum plotters use this technique. A drum plotter substitutes a cylindrical drum for the bed used in the flatbed printer. The paper is affixed to the drum, which is free to rotate in either direction. The gantry arm is locked in a single position, and the pen is permitted to move along it in either direction. Pen motion in the x-axis direction is accomplished by rotating the drum; y-axis motion is achieved in the same way as on the flatbed, by moving the pen along the gantry arm.

The first low-cost plotters were of this type, and variations on this technique are now used in some larger plotters.

The major disadvantage of drum plotters is their relatively slow speed. The drum to which the paper is attached is a high-mass item that cannot be made to change direction as quickly as a low-mass moving gantry arm.

Paper has a much lower mass than either a drum or a gantry arm. If paper could be made to move without the additional mass of the drum, lower-cost motors and controls could be used, further reducing the cost of the plotter while providing higher speed capability. Enter the paper mover.

The paper mover employs various forms of gripping wheels to hold the edges of the paper during plotting. The paper is rocked back and forth as required between the gripping wheels, and the pen moves along a fixed gantry arm as it does in the drum plotter.

This type of plotter has the lowest mass to be moved, but it also has the poorest control over paper placement. Since the paper is held in a friction device, sliding may occur, causing registration problems and interfering with precise repeatability. It's virtually impossible to place a previously drawn plot on the plotter for overlay purposes. But if these concerns are not germane to your application, this plotter type can offer extremely good price/performance characteristics. ▲

DMP 29 is an eight-pen flatbed model, while the DMP 40 uses only a single pen and is a paper slider. A two-pen model of the DMP 40 is on the way.

Calcomp M84. Calcomp began in the early 1960s as a plotter company and rapidly grew to dominate the market for large-scale high-performance plotters. Now a division of Sanders Associates, Inc., Calcomp is perhaps the premier plotter manufacturer in the mainframe computer market and the expanding CAD/CAM marketplace. The Calcomp M84 is the first plotter offered by this company in the under-$2,000 price range.

The M84 is a sturdy piece of office equipment. It is relatively quiet and simple to operate, and a variety of pens are available for it. Calcomp has brought its many years of experience to bear on the selection of pens for almost any application imaginable. Almost every type of pen offered for the company's much more expensive line of mainframe plotters can be obtained for use with the M84.

Eight pens in conjunction with software permit unattended plotting of almost all business graphics applications. The M84 uses an electrostatic paper hold-down technique, activated by a button on the front panel. Simply stated, the platen (the surface upon which the paper or transparency is placed during plotting) is electrostatically charged. This causes an attraction similar to magnetic attraction, holding the paper precisely in place while the pen moves along both the x and y axes. Plotters that hold the paper in position are capable of better registration and plot repeatability. This can be important if several charts are to be plotted on the same piece of paper, either overlaying each other or side by side.

The M84's resolution—its ability to move to and discriminate between adjacent points on the plotting surface—is very good at .004 per inch. Taking advantage of this high resolution requires very fine pen nibs. The M84 controls the x and y motors with its own Z-80 microprocessor; the Z-80 also provides six character fonts and automatic circle and axis generation.

Three interfaces are available: RS-232C, parallel, and IEEE488 (GPIB). The interface is provided on a separate card that slides into the back of the M84 and provides DIP switches for baud rate (maximum 9600), parity, and mode.

IBM X/Y 749. IBM's Instruments Division has added the X/Y 749 to its product line as an output device for its 68000-based laboratory computer system. Although the primary interface in this environment is GPIB, RS-232C and eight-bit parallel interfaces are also available. IBM also offers a special pc connection cable as an extra-cost option.

Several IBM mainframe graphics packages also support the X/Y 749 as an output device. In descriptions of these software products, customers are directed to contact their IBM Instruments Division office to obtain information about (or to order) the plotter. This plotter is not currently available through the Data Processing Division sales organization or the Product Centers. Authorized pc dealers don't find it on their order sheets, either.

The X/Y 749 is manufactured for the Instruments Division by Goerz of Austria, a very experienced manufacturer of small plotters. This is the same company that builds the Calcomp M84, and the two products are, in fact, identical.

Like its sibling, the X/Y 749 has eight pens, a Z-80 microprocessor, 8K ROM, and a 2K buffer. Interface options are the same as for the M84, and their settings are controlled as described earlier. The X/Y 749 uses a superset of the commands used by its bigger ("B" size) and older brother, the IBM X/Y 750. It therefore works with any software package containing an X/Y 750 driver. All eight pens on the X/Y 749 may be software addressed, making this plotter one of three reviewed that are capable of completing most charts in unattended mode.

The X/Y 749 is painted to match the pc and looks right at home at its side. Warranty and service are provided on a return-to-service-center basic by the Instruments Division.

If you're choosing between the M84 and the X/Y 749, the only bases for discrimination are product availability and any extras that may be included as part of the purchase price. Things to look for include cables, starter kits (pens, paper, and so on), and service locations.

Hewlett-Packard 7470. The 7470 was there first and had few if any challengers until recently. Its combination of plot speed, line quality, physical size, and dealer availability make it an excellent choice even when compared with the newer challengers.

The 7470 is a paper mover offering two pens and "A" size drawings. As the paper rocks back and forth, it extends full length in front of and behind the pen bar. Therefore cleared areas, both in front and in back, are required.

H-P provides a good supply of pen types, offering two widths in each of eight colors—for transparency and paper use. It's also clear that H-P knows how its customers use plotters. With each unit, the company provides a comprehensive catalog that describes all the options and supplies available to support business graphics.

The 7470 is not the fastest plotter in the linear speed derby, although when the same plot was tested on all five machines, the 7470 turned out to have an edge in overall plot time. When more than two pens were required, plot

time lengthened; this resulted from the need to change the pen manually and to signal the program to proceed. The more pens called for, the more of a disadvantage the 7470 faces when compared to the eight-pen machines.

Because of the paper-moving nature of this beast, registration is not one of the 7470's strong points. Even if paper is not removed between plots, it's virtually impossible to overlay two charts on the same set of axes. Once in our tests, the overzealous plotter lost its firm grip on the paper and shoved it completely out of the gripping wheels to sail across the desk. Although this seemed humorous at the time, the pen continued on, plotting away right on the platen. Fortunately this is not a common occurrence and should not be of great concern.

The 7470 recently underwent a substantial price reduction, making it even more attractive than before. In an environment where volume is low or time is not money, this machine is the odds-on favorite. In higher-volume situations or those where a paid employee must provide the pens on demand, the 7470 must be evaluated on a "product life cycle" basis, where consideration is given to the acquisition cost, ongoing supplies cost, and operating costs. Under these circumstances the more expensive multipen units have the advantage.

Houston Instruments DMP 40 and DMP 29. This company (now a subsidiary of Bausch & Lomb) has been in the plotter market for many years, having taken a different approach than many other companies. HI specializes in the high-quality smaller printers often used in laboratory environments and as peripherals to automated test and measurement equipment. The company now offers a variety of general-purpose high-performance plotters for use with both personal computer and mini/mainframe applications.

Houston Instruments has two offerings, one positioned at the bottom and the other at the top of the price spectrum. Both are "B" size, which permits them to make larger plots than any of the other products reviewed. They will, of course, make "A" size drawings when properly configured by means of touch-sensitive switches on their operator panels.

The DMP 40 is the least costly plotter of the five we're considering. It offers only one pen. It has been included here because a two-pen version will soon be available; the two-pen DMP 40 will be functionally comparable to the H-P 7470.

The DMP 40 is also a paper pusher; its technique for moving the paper is slightly different from that used by the H-P. Loading paper into the DMP 40 is accomplished by lining up two of the paper edges with marks on the plotter and lowering two pressure wheels onto the paper. These wheels, one at each edge of the paper, press the sheet against a roughened metal roller below. As the paper is moved back and forth, the pattern of the roughened steel roller is embossed on the two edges of the paper. These patterns provide a positive lock between the paper and the steel wheel.

At the other end of the price spectrum is the DMP 29, an eight-pen flatbed device that's the most costly of the group. On the DMP 29, paper is held in place using specially provided two-sided tape. Once the paper is positioned and "stuck down" and the correct size ("A" or "B") selected, plotting proceeds more or less as it does in the previously described eight-pen units. The idea of using two-sided tape may seem "low tech" at first, but it's effective. A trick described in the documentation is to clean the tape periodically, using a piece of masking tape to pull any dirt or foreign substances from the outward facing side of the tape. This technique works and appears to rejuvenate the tape for continued use.

The DMP 29 is the fastest of the units tested. It's also the noisiest and the biggest. This plotter can be unforgiving if a user places paper in the "A" size position and then forgets to press the "small plot" pressure-sensitive switch on the front panel. If this occurs, one

half of the plot will be semipermanently drawn on the platen.

Both HI units offer multiple character sets and circle commands. Pens are interchangeable between units and come in quite a variety of colors. Parity and baud-rate adjustments are made via switch settings on the DMP 29 but are a little more difficult to set on the DMP 40. On the latter machine, you have to press combinations of front panel switches in order to make the necessary changes. The steps and switch-setting combinations required are well documented, but there are so many of them that constant reference to the manual is likely to be necessary. A quick-reference card might be very handy.

Conclusion. If price is an overriding concern, the DMP 40 is an excellent buy; it works with most of the software packages on the market. If you need unattended operation and you're going to be producing large quantities of multicolor prints, the Calcomp M84 and IBM X/Y 749 make excellent choices; they're also supported by most packages. With IBM and Calcomp both behind this plotter, it is likely to gain a high level of software support.

The HI DMP 29 provides multipen capability for those who need the larger drawing size, but it is noisier during operation and takes up unnecessary space when "B" size drawings are not required. It is also the most expensive of the products reviewed here.

The HP 7470 may be the best compromise product of the group, offering modest price and excellent output quality. Two pens are more than adequate for charts that are being reproduced in monochrome, and the inconvenience of manual pen changes won't be noticed in situations where multicolor plots are the exception rather than the rule.

A Last Point. Much has been said about "self-capping" pens. The HP 7470 is the only plotter in the group that has this feature. When the two pens are returned to their stalls, they are held in such a way that the inked tips are covered to prevent evaporation. This arrangement was especially important when fast-drying inks had to be used to prevent smearing. With today's pens and inks, smearing has become less of a problem. Good housekeeping techniques will probably do more than the self-capping feature to guarantee longer pen life. ▲

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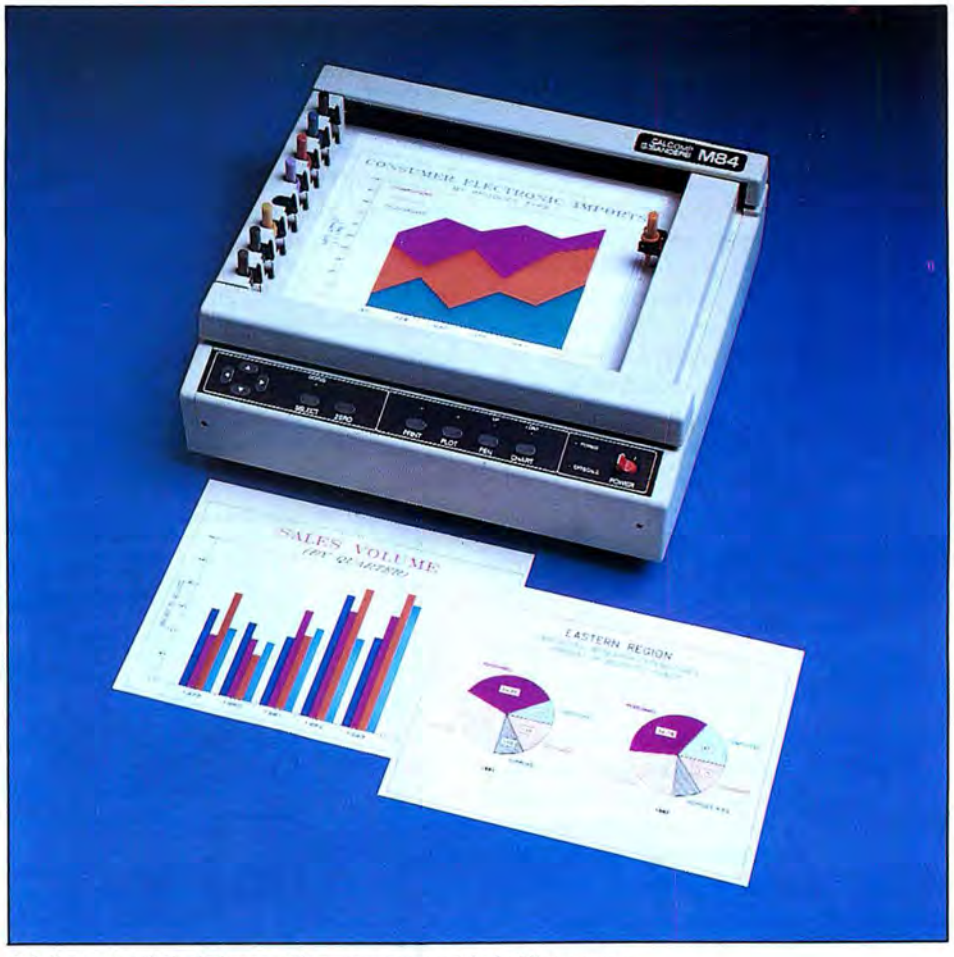
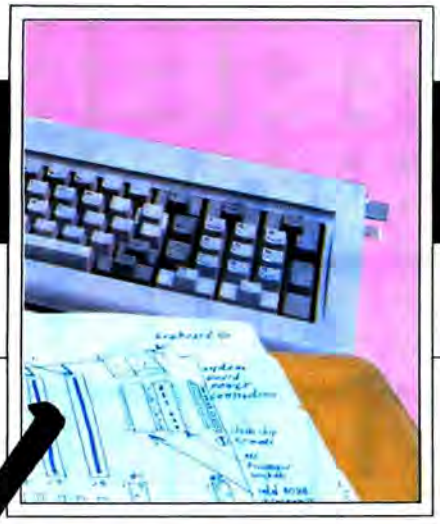
Calcomp, 2411 West La Palma Avenue, Anaheim, CA 92803. (714) 821-2011.
Hewlett-Packard, 3000 Hanover, Palo Alto, CA 94304. (415) 857-1501.
Houston Instruments, 8500 Cameron Road, Austin, TX 78753. (800) 531-5205.
IBM Instruments Division, Kenosia Avenue, Danbury, CT 06810. Call 1-800-555-1212 to get the toll-free number for your dialing area.



A fully loaded flatbed plotter with gantry arm at right holding one pen.

	Calcomp M84	IBM X/Y 749	HP 7470	HI DMP 29	HI DMP 40
Type					
Flatbed	●	●		●	
Paper Mover			●		●
Number of pens	8	8	2	8	1*
Interfaces					
RS-232C	●	●	●	●	●
8-Bit Parallel	●	●		●	
IEEE 488 (GPIB)	●	●	●	●	
Drawing Size					
A	●	●	●	●	●
B				●	●
Number of speeds	2	2	3	5	1
Maximum rated speed	16.5	16.5	15	22.6	4.2
Hold-down					
Electrostatic	●	●			
Gripping wheels			●		●
Tape				●	
Price	$1,995	$1,995	$1,095	$2,295	$895

*2 available soon



SYSTEM Notebook

by Alan Boyd

Through Pipes into Filters, Part 2

In the past few installments we have seen that several of the new features of DOS 2.0 are a direct result of its input/output redirection capabilities. The most significant features that we have studied so far are pipes and filters. This month we'll look a little more deeply into both pipes and filters.

A filter, as you may remember, is a DOS command that accepts standard or redirected input, modifies or acts on it in some way, and sends it on to a standard or redirected output. Filter commands are all external DOS commands, which means that before they can be used they must be resident on the system disk. In addition to being useful in their own right, the three filters that are supplied with DOS serve as excellent examples to those wishing to create their own customized filters.

Sort. The *sort* filter, we discovered last month, performs a line-oriented sort based on the eight-bit ASCII sequence; *sort* works either on a specified file or interactively with keyboard entry.

There are a pair of switches associated with *sort*, one of which, the +n switch, we saw last month. The +n switch is used to specify that the *sort* should proceed from a character position other than the beginning of the line.

Sort's default condition specifies a collating sequence that runs from lowest to highest (in ASCII rank). The second switch, +r, can be used to reverse the standard sort order.

When using the *sort* filter on nontext files, or even text on files that contain embedded nonprinting characters—formatting commands, for example—you should exercise caution. The ASCII code allocates to each character a number between 0 and 255. The standard ASCII sequence begins with several nonprinting control characters—such as the BEL character (character 7), which when printed on the pc causes the speaker to beep. If your "text" file contains any of these nonprinting characters, you are likely to get some rather surprising and possibly exasperating results.

Sort can work with files as large as 63K. If you attempt to use *sort* on a file larger than 63K, you will get the error message

SORT: Insufficient memory

Find. As we learned last month, the *find* filter is a utility that can be used to identify all lines containing a specified string; the output of the *find* command consists of only those items that contain one or more occurrences of the specified string. In the example we used earlier, we had *find* locate all of the items in a file that contained the string "Los Angeles". *Find* also has some other capabilities that greatly increase its power; these extra features are usually tapped via switches attached to the command.

The first switch we'll look at is /V, which causes *find* to operate "bass-ackwards" relative to its default condition: With the /V switch in effect, *find* passes all items that do not contain the specified string.

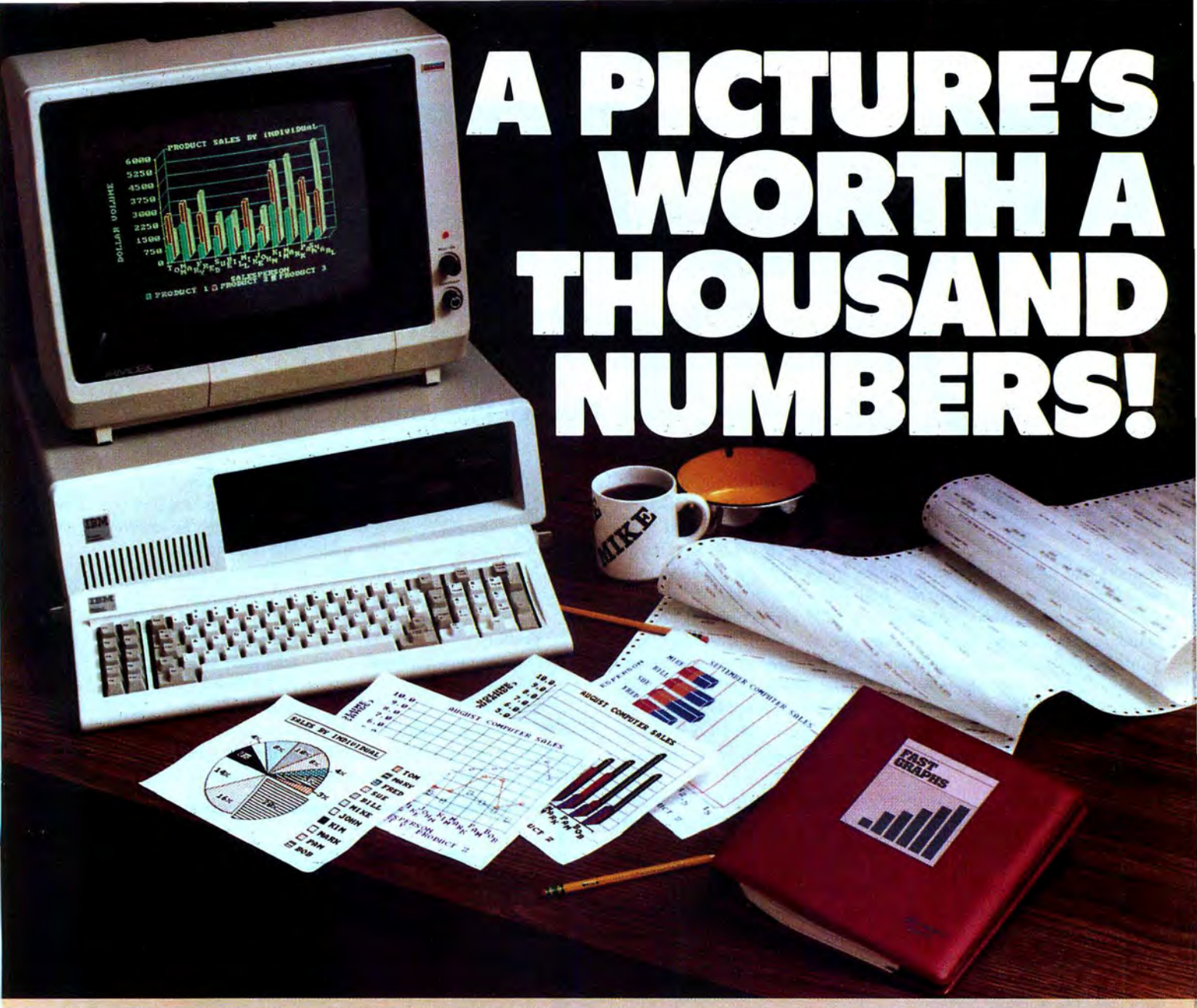
Recall that in our examples last month we had *find* locate and pass all the lines in the file that contained the string "Los Angeles". Using the /V option, we could instead have *find* pass only those records that do not contain the string "Los Angeles". The command:

```
A>FIND /V "Los Angeles" TABLE
```

would result in the following output:

```
----------TABLE
Vendor                  City            Cost
Fortnum International   Chicago         101.99
Widgets Inc             New York        104.15
Smith Inc               San Francisco   101.85
```

The /V switch enables you to use multiple criteria to eliminate items in a file, by successively refiltering the file through *find* many times. For example, if we wanted to locate all of the vendors in our sample file



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```
Vendor                  City           Cost
International Corp      Los Angeles    123.44
Fortnum International   Chicago        101.99
Druryl Imports          Los Angeles    102.55
Applied Systems         Los Angeles     95.00
Maxwell Smart Widgets   Los Angeles    104.15
Widgets Inc             New York       104.15
Allied Widget           Los Angeles     99.88
Smith Inc               San Francisco  101.85
^Z
```

that are located in neither Chicago nor New York, we could first run the file through the *find* filter and eliminate all the records that contain "Chicago"; the output of that operation could then be piped back to a *find* filter that would eliminate all records containing occurrences of the string "New York". The command to do all this would look like

```
A>FIND /V "Chicago" TABLE | FIND /V "New York"
```

and would result in the following report:

```
----------TABLE
Vendor                  City           Cost
International Corp      Los Angeles    123.44
Druryl Imports          Los Angeles    102.55
Applied Systems         Los Angeles     95.00
Maxwell Smart Widgets   Los Angeles    104.15
Allied Widget           Los Angeles     99.88
Smith Inc               San Francisco  101.85
```

We can pipe the output from one operation back through the same filter as often as we need to in order to pare the file down to whatever information we require. If, for example, we wanted to eliminate the header line and the blank line under it, we could add yet another re-filtering operation to the command just shown; the final filter would pass only those lines that contain a decimal point. That would result in a report like this:

```
A>FIND /V "Chicago" TABLE | FIND /V "New York" |
FIND "."
International Corp      Los Angeles    123.44
Druryl Imports          Los Angeles    102.55
Applied Systems         Los Angeles     95.00
Maxwell Smart Widgets   Los Angeles    104.15
Allied Widget           Los Angeles     99.88
Smith Inc               San Francisco  101.85
```

Notice that when the *find* filter has its input piped from another process, you don't have to specify the source of input, since input defaults to the source of all piped data, the standard input.

The second switch that can be applied to the *find* command is /C. The /C switch suppresses *find*'s conventional output, causing the command instead to write a count of the matching items. For example, in the command just shown, only six items met the selection criteria; if we were to modify the command by setting the /C switch on the final *find*

```
A>FIND /V "Chicago" TABLE | FIND /V "New York" |
FIND /C "."
```

the command would send to standard output only the count of items meeting the selection criteria. This form of the command is useful when you're examining very large files; instead of waiting while all the items are printed on-screen, you can find out immediately how many items the output has been pared down to.

The third switch associated with the *find* filter, /N, is used to display the relative line number of each matching item. Setting the /N switch causes *find* to tack on a number at the beginning of each qualifying line; the number represents the line number in the input file from which the selected item was derived.

For example:

```
A>FIND /N "Chicago" TABLE
---------- TABLE
[4]Fortnum International        Chicago    101.99
```

The [4] is the line number in the original file (Table) from which the line was taken. Notice that blank lines are significant when it comes to line numbering. The /N switch is useful as a quick and dirty way of finding which lines in a file match a given selection criteria. The line numbers that are generated can be used with a text editor to edit the lines involved.

One final feature of the *find* command that is particularly useful is its ability to operate on a list of files. To take advantage of this feature, you simply include the list of files on the command line. Symbolically, here's how this version of the command looks:

```
FIND "string1" file1 file2 file3 ...
```

To make the idea more concrete, let's first take the Table file that we built earlier and break it into several smaller files. This can be done in the following way:

```
A>FIND "Los Angeles" TABLE >TABLE1
A>FIND "New York" TABLE >TABLE2
A>FIND "Chicago" TABLE >TABLE3
A>FIND "San Francisco" TABLE >TABLE4
```

We've created four subfiles, each of which should contain a list of vendors in the specified city. Now, if we want to create a list of all items in any of those four files that contain the letter *i*, we can simply specify the entire list of files that we just created. If we do that, here's what happens:

```
A>FIND "i" TABLE1 TABLE2 TABLE3 TABLE4
---------- TABLE1
International Corp      Los Angeles    123.44
Applied Systems         Los Angeles     95.00
Maxwell Smart Widgets   Los Angeles    104.15
Allied Widget           Los Angeles     99.88
---------- TABLE2
Widgets Inc             New York       104.15
---------- TABLE3
Fortnum International   Chicago        101.99
```

```
---------- TABLE4
Smith Inc                 San Francisco    101.85
```

Incidentally, this example illustrates why in each report *find* indicates the source file by displaying, for example,

```
---------- TABLE1.
```

If you want to remove the headers you can pipe the output through the filter yet another time, as we did in an earlier example.

One point you should note about using a list of multiple source files with the *find* command is that the global filename characters—* and ?—are unfortunately not permitted. This means that the command

```
A>FIND "i" TABLE?
```

is illegal and will result in the error message

```
FIND: File not found TABLE?
```

This leads us to another important property of DOS related to the concepts of standard input and standard output. To illustrate this concept, suppose that while entering a list of files for the *find* command you accidentally enter the name of a nonexistent file. What will happen? Let's try it and see. Type

```
A>FIND "i" TABLE1 TABEL2 TABLE3
```

Note the spelling error in the second filename. As we might expect, DOS generates a screen report with an embedded error message:

```
---------- TABLE1
International Corp        Los Angeles      123.44
Applied Systems           Los Angeles       95.00
Maxwell Smart Widgets     Los Angeles      104.15
Allied Widget             Los Angeles       99.88
FIND: File not found TABEL2
---------- TABLE3
Fortnum International     Chicago          101.99
```

If we were using the *find* filter to produce a file for use with another program, this error message might very well get in the way of further processing. For that reason, DOS was designed so that such error messages are not sent to the standard output device; instead they always go only to the screen. This means that if we were to redirect the output of the last command to a file instead of to the screen, the error message would not be written to the file.

This feature is similar to the Diagnostic Output, also called Standard Error, of Unix and Xenix. It has two beneficial attributes. The first is that output files don't get cluttered up with error messages; the second is that we don't have to wait until processing is finished to discover that DOS encountered an error.

More. As we saw last month, the *more* filter simply halts output to the screen after each screenful. It then prints a prompt on the screen and waits for any key to be depressed. That describes the entire operation of *more*; it has no switches or options.

There are two ways to use the *more* command, both of which produce the same results. It may be used directly, or it may get its input via a pipe from another command. Examples of each form are

```
A>TYPE MYFILE.TXT | MORE
```

and

```
A>MORE <MYFILE.TXT
```

and both achieve the same results.

Making Your Own Filters. Now that you've seen the power of filters, it's time to look at the exciting possibilities of rolling your own. Since Basic (starting with version 2.0) supports the concepts of standard input and standard output, it is really quite easy to design custom filters. In fact, any program that communicates with the hardware via DOS will support filters. However, programs that bypass DOS and interface directly with the hardware will not work; trying to redirect I/O using a program that bypasses DOS can be dangerous; the effects are unpredictable.

Basic itself is structured as a DOS command, so it is entirely possible to create filter commands by using the interactive mode of Basic directly from DOS. To see this for yourself, first prepare a file called Nums:

```
A>COPY CON: NUMS
PRINT 3*5
^Z
```

This file can now be used as input to the Basic command line editor in the interactive mode. Simply enter

```
A>BASIC <NUMS
```

which tells DOS to load Basic and receive input to the editor from the file called Nums. The result will be

```
OK
PRINT 3*5
 15
A>
```

Before the interpreter was started, the screen was blanked, which always happens when Basic is fired up. Then the standard prompt, OK, which Basic emits to show that it's in interactive mode, is output. Input is then redirected from the file named Nums, which enters the line *print 3*5*. Basic (which, incidentally, cannot differentiate between data entered through the keyboard and data being redirected from a file) then calculates the result, prints it out, and returns control to the operating system.

The previous example redirects input to the Basic interpreter's interactive mode. It is, however, just as feasible to use Basic in its deferred mode by writing a Basic program and calling it from DOS. Try the following example:

```
A>COPY CON: NUMS
4
6
^Z
                        1 File(s) copied
A>BASIC
```

```
OK
10 INPUT A
20 INPUT B
30 PRINT A * B
40 END
SAVE "MULT
OK
SYSTEM
```

In this example we first created a file, called Nums, containing the numbers 4 and 6, each on a separate line. We then loaded the Basic interpreter so we could write a short Basic program, which, when run, requested that two numbers be input, multiplied the numbers, and printed the results. We saved the program under the name Mult and returned to DOS.

Now let's run the program directly from DOS. We'll do that by redirecting Basic's input to the file Nums:

```
A>BASIC MULT <NUMS
? 4
? 6
 24
A>
```

That loaded Basic, which then ran Mult; when Mult requested input, it was taken from Nums.

This demonstrates how a Basic program may be used in the deferred mode with redirected input. Now recall that a filter is simply a DOS command that accepts its input from the standard input and sends its output to the standard output (assuming of course that no I/O redirection has been specified). That means it should be quite simple to create a custom filter by writing it in Basic. Let's look at an example.

In many programming applications it is desirable to work with files that have line numbers. The following Basic program reads lines in from the keyboard and prints them on the screen with line numbers assigned.

```
10 ON ERROR GOTO 70
20 LINENUM = 1
30 PRINT LINENUM; ": ";
40 INPUT "", A$
50 LINENUM = LINENUM + 1
60 GOTO 30
70 END
```

The *on error* statement in line 10 is simply a quick and dirty way of detecting the end of a file when the program is used as a filter. If we then save the file by entering

```
SAVE "LINENUM
```

we can later invoke it as a DOS command with its input and output redirected—in other words, as a filter. To do this, we'll of course need a test file to run through it; the Table file that we created earlier will do quite nicely. The command and the resulting output would be:

```
A>BASIC LINENUM <TABLE
 1 : Vendor                    City          Cost
 2 :
 3 : International Corp        Los Angeles   123.44
 4 : Fortnum International     Chicago       101.99
 5 : Druryl Imports            Los Angeles   102.55
 6 : Applied Systems           Los Angeles    95.00
 7 : Maxwell Smart Widgets     Los Angeles   104.15
 8 : Widgets Inc               New York      104.15
 9 : Allied Widget             Los Angeles    99.88
10 : Smith Inc                 San Francisco 101.85
11 :
```

If you wanted to create a separate file containing this information it would be just as easy to redirect the output to a file. The procedure

would look something like this:

```
A>BASIC LINENUM <TABLE >NEWTABLE
```

where Newtable is the name of the new file created to hold the line-numbered information.

You can give a name to a DOS filter command, such as the one we have just created, by storing the invocation command in a Batch file:

```
A>COPY CON: NUM.BAT
BASIC LINENUM
^Z
        1 File(s) copied
```

Num can now be treated like any other DOS file. The last command now becomes:

```
A>NUM <TABLE >NEWTABLE
```

In this form, the new command looks and feels much more like a regular DOS command (although, since the Basic interpreter is involved, it will operate considerably more slowly than other DOS commands). This form is much more intuitive for an unsophisticated user to recall and use.

The command can also act as a filter to which data can be piped from another command. For example, we can achieve the same result of adding line numbers by typing the contents of the file with the output piped to the Num command; the output of the Num command could then be directed to the final file.

Even though all of the demonstrations so far have used different source and target files, it is actually possible to redirect the output of a command to the same file from which input is being drawn. Since that replaces the input file, this is definitely not a recommended practice. However, if you do it:

```
A>NUM <TABLE >TABLE
```

you should first make a backup of the original file, Table. In order to pull off this trick, DOS first reads all the information out of the source file and then bulk processes it through to the target file, creating temporary files where necessary and using as much excess memory as possible.

Piping works in exactly the same way. In fact, there is a very simple method of showing the process at work, by essentially having the computer catch itself in the act. Doing so lets us derive information about exactly how DOS manages pipes and filters. The trick is to issue the command sequence required to sort the directory listing and print it on the screen:

```
A>DIR | SORT
```

If you apply this command to a blank disk, you may be very surprised to find that at the time DOS goes to look at the directory listing, there are actually two files present. The files have the names %PIPE1.$$$ and %PIPE2.$$$; DOS creates these temporary files as it needs them and allocates names in the sequence as required. If you list the directory a second time, after the piping is complete, you'll find that the files have vanished; DOS automatically removes them when they're no longer needed.

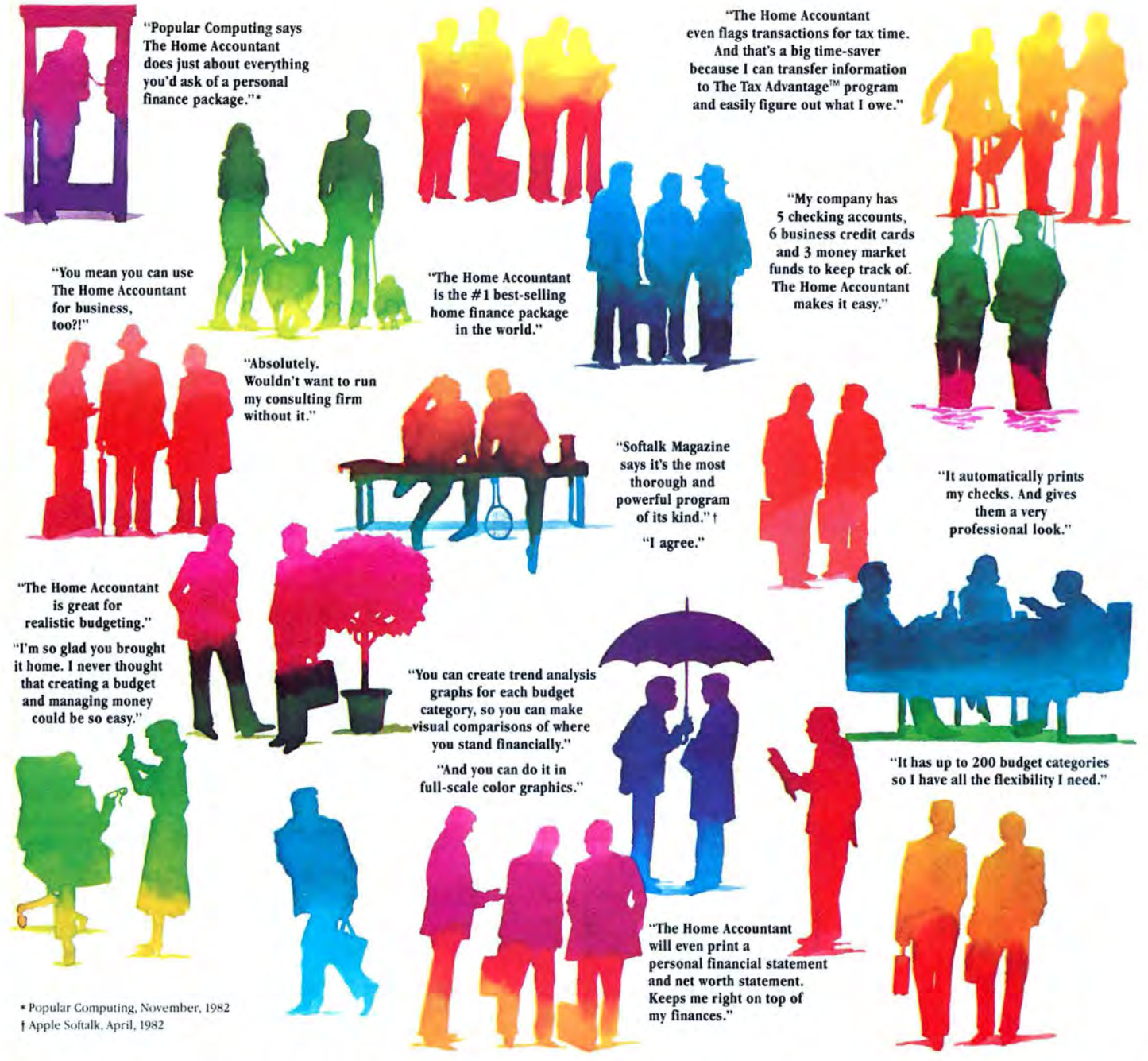
It's always dangerous to use a filter command that erases the file from which data is being extracted. Although in many cases it can be done without any harm, in other cases it can lead to an aborted operation, one that halts after the source file has been deleted and before the target file has been created and thereby destroys the data itself. Practices such as these are very dangerous and should be avoided.

Summary. I/O redirection is one of the most important and useful of all of DOS 2.0's new facilities; its capabilities are unique in a single-user operating system. When logically extended to pipes and filters, I/O redirection offers a level of power and versatility matched only by much larger and more expensive operating systems, such as Xenix and Unix.

One of the most highly touted features of Bell Labs's Unix operating system is that the family of users writing software for it has created a vast library of extended operating system commands. This library has become so extensive that it is almost trivial to create incredibly complex commands from the plethora of available commands. Over time DOS will also acquire such a library.

In this light is has become increasingly obvious why any professional program written to run in DOS must have its input and output operations handled by the operating system, rather than by calls made directly to the hardware. If a program uses the standard input as its source of input and standard output as its target, then it can be simply treated as a standard DOS filter command. That lets users custom-design their own programs by stringing together programs in a modular fashion.

There are, of course, some programs that simply do not lend themselves to such usage. For example, there is as yet no definitive standard for passing graphics parameters from one program to another at the operating system level, so programs using graphics cannot be treated as filters (although data can still be piped to and from them via standard input and standard output). One day there will be a standard format in which other types of data, such as graphics and voice information, can be passed between programs. Practice with the input/output redirection facilities already available under DOS will leave you well prepared for that time. ▲



* Popular Computing, November, 1982
† Apple Softalk, April, 1982

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Part Four

A PRIMER ON NETWORKING

The following is the fourth in a series of articles excerpted from the book Communications and Networking for the IBM PC, *by Larry Jordan and Bruce Churchill, and published by the Robert J. Brady Co. Note: this material was written before the introduction of DOS 2.0.*

This month we continue our survey of the first three local area networks to be implemented on the IBM Personal Computer. In this installment we'll look at Omninet, from Corvus Systems (2029 O'Toole Avenue, San Jose, CA 95131; 408-946-7700).

Omninet System Overview.

Omninet was originally released in mid-1981 for the Apple II, Onyx, and DEC LS-11. A revision of Omninet's software component has brought the Omninet system to IBM users as well. The current version of this network can address as many as sixty-four devices, and these can be comprised of pcs, Corvus Concepts, Apple IIs, and other computers.

The software supplied with Omninet is called *Constellation II.* This software allows resource sharing and file transfer. It differs from the earlier *Constellation I* software in that it enables the system to be used with computers other than the Apple II.

Omninet operates at a one-megabyte-per-second data-transfer rate. Its software runs under PC-DOS and on systems equipped with either the UCSD p-System or CP/M-86.

Omninet can be classified as a baseband distributed bus network with CSMA access protocol. It does not support a collision-detect feature. Instead it uses a transport-layer protocol (layer 4 of the ISO seven-layer model—see the August installment of this series) to seek acknowledgement of successful receipt of message packets at the destination device.

The current version of the network makes use of disk servers—interface devices that allow many computers to access data from a common hard disk drive. Eventually the system will also incorporate print servers, Corvus Mirror servers, communications servers, and gateways.

Recall that a server is a device that interfaces any nonintelligent or semi-intelligent peripheral to a network. Disk servers and printer servers are the devices people are most accustomed to seeing. These devices are used to allow file transfers or printing to and from expensive network resources, such as hard disks and letter-quality printers. A Corvus Mirror server is an interface to a videotape data backup capability; this mass-storage technique is a low-cost method of archiving (storing) large amounts of data via ordinary videotape recorders.

by Bruce Churchill

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A communications server provides shared access to a number of modems attached to the network.

A gateway is a special kind of communications server. It's a device that interfaces dissimilar networks through the use of protocol-translation software and/or firmware. The networks involved may be any combination of LANs and modem networks. Depending on the complexity of the networks being hooked together, a gateway can become a relatively expensive device.

Figure 1 shows the general layout of an Omninet system.

Omninet Hardware.

General Information. Omninet is implemented on a pc adapter card called a transporter, which functions in much the same manner as the PCnet I network adapter card (see last month's installment). While PCnet I uses a coaxial cable, pcs in Omninet are interconnected by means of a twisted-pair wire. The RS-422 electrical signaling standard used on the PCnet I coax is also used on this twisted pair. This wire can be made from low-cost telephone wire. The maximum length Omninet can accommodate is 4,000 feet. Wire running from the transporter card to the main network bus is connected to the bus through a simple terminal box.

The disk server acts as the interface between the hard disks and Omninet. It also manages multiple-user to any hard disk drives that are connected to it. Up to four Corvus hard disk drives, each with up to twenty megabytes of storage, may be hooked up to one disk server. Any number of disk servers may be connected to Omninet, within the sixty-four-device limitation.

Transporter Card. The transporter card implements Omninet's collision-avoidance protocol. This card is capable of determining when the network is available to accept a transmission, and it also computes a randomized transmit start time for data packets, so as to minimize collision possibilities. As mentioned earlier, the transporter card also implements a transport layer protocol that provides an economical form of virtual circuit between two communicating devices (an IBM pc and a disk server, for example). This virtual circuit guarantees either that a data packet on the network will get to its destination or that a nondelivery notification will be made to the sending device. The protocol also discards duplicate messages and ensures that data packets are received in the order they were transmitted. If acknowledgement is not received, the transporter attempts a user-specified number of retransmissions. If the CSMA circuitry detects that data is already on the network, retransmission is not attempted.

All the functions just mentioned take place without CPU intervention, so computer memory and processing time are not taken up. The technique used is DMA (direct memory access). The transporter card also controls the flow of data into and out of its host pc's RAM.

Disk Server. The disk server consists of a transporter card for interfacing to the network and a Corvus disk system interface for controlling hard disk access. The transporter allows the disk server to function similarly to any other device on the network. The disk file interface ensures the proper routing of communications between workstations and the hard disk. It also maintains a file, called the *network active table*, on the hard disk. This file relates Omninet user or server names to host numbers. A host number is the permanent identifier for each device on the network. The network active table is used by software to locate active Omninet users and servers.

Other Servers. A print server will soon be added to the list of devices Omninet can address. It will be combined with a communications server in one enclosure. The print server's function will be to buffer print files from any number of network users and to maintain a prioritized print queue for batch printing. The communications server will allow modems to be connected to the network. These modems will then be addressable from any user pc as Com2:.

Similar to a server is the Omninet gateway device for interconnecting Omninets or linking them to systems such as Ethernet, SNA, and other modem networks.

Hard Disk Drives. The hard disk drives that work with Omninet are Corvus drives; the disk server doesn't support other drives. Drive capacities of six, eleven, or twenty megabytes can be accommodated. Firmware in the disk drive supports multicomputer file transfers (pipes), concurrent file access (semaphores), backup (Mirror), and network initialization.

Omninet Software: Constellation II

The primary high-level networking software Corvus provides for use with Omninet is collectively known as *Constellation II*. *Constellation II* is just one of the many protocols Omninet can support. Its significance lies in its ability to allow single-user operating systems to share resources in a local area network environment without extensive software modification.

The functions of *Constellation II* are threefold: to allow access to shared resources such as hard disks, to transfer files between network users independent of the type of computer or operating system, and to allow concurrent file access. *Constellation II* also permits print sharing; until print servers become available, printers must be attached to an IBM pc or other workstation connected to Omninet.

Constellation II differs from the PCnet software in two significant ways. First, unlike PCnet, *Constellation II* works with multiple operating systems, and second, it uses detached hard disk drives with their accompanying servers. These differences make the Omninet software somewhat more difficult to understand than the PCnet I software, although this complexity only manifests itself to the individual who is designated the system manager.

Constellation II software consists of four levels of system support: hard disk firmware, disk server firmware, operating system drivers, and support software. The hard disk firmware performs disk sector read and write housekeeping, establishes and maintains a common buffer area on the hard disk for dissimilar DOS file transfers (this buffer area is referred to as the *pipes*), manages file-locking procedures for concurrent access, and maintains boot areas on the hard disk to be used by the individual operating systems. These boot areas contain assembly language programs

Figure 1. OMNINET SYSTEM INSTALLATION

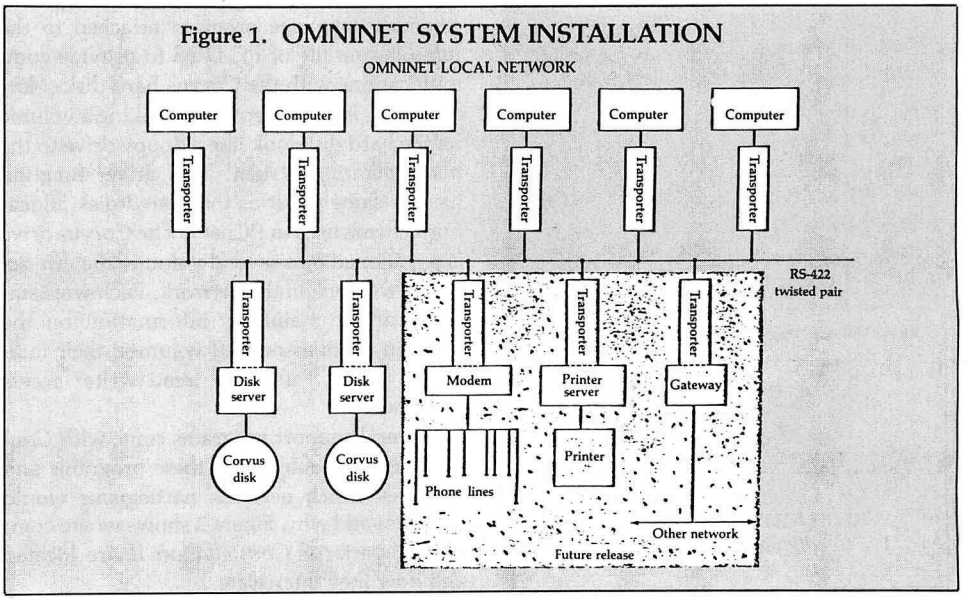
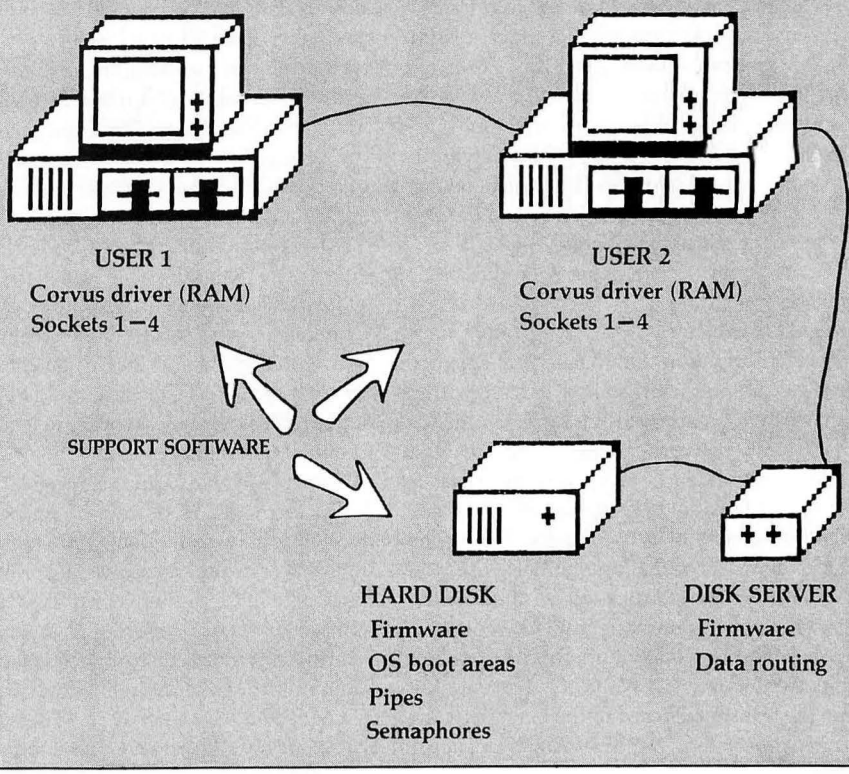


Figure 2. CONSTELLATION II SOFTWARE AND FIRMWARE



that allow the supported operating system to initialize itself for the appropriate Corvus disk interfaces.

The disk server firmware has two relatively simple tasks: to ensure that the originator of any data access request is identified, so that the return data flow goes to the workstation, and to communicate with other servers and users in order to maintain a table of active network users.

Drivers allow each operating system to access the Corvus hard disk as if it were a mass-storage peripheral attached to the host workstation. A driver is nothing more than an assembly language program attached to the Ibmdos.com file of PC-DOS to provide communications with the Corvus hard disk. Normally this is implemented by making a volume on the hard disk look like a floppy drive to the host operating system. This driver function has the same result as the shared disk allocation scheme used in PCnet I. The Corvus drive is partitioned into several volumes that are assigned to users on the network. Each workstation's driver maintains information on the location of its associated volumes, their individual sizes, and the read/write access allowed.

Several support programs come with *Constellation II*. Table 1 lists these programs and indicates which network participants would use them and why. Figure 2 shows where component parts of *Constellation II* are located and how they interrelate.

Table 1. CONSTELLATION II SUPPORT SOFTWARE

System Manager	
	• Drive Manager
	• User Manager
	• Access Manager
	• Boot Manager
Maintenance Manager	
	• Installation program
	• Disk diagnostics
	• Omninet diagnostics
	• Recovery programs
	• Mirror programs
Individual Network Users	
	• Mount Manager
	• Library procedures

Omninet Operation

An appreciation of Omninet's capabilities and limitations in a working environment can best be gained by taking a more detailed look at disk sharing, operating system interfaces, and network operation.

Disk Sharing. Disk sharing is the bread-and-butter element of any network operation requiring multiple-user access to databases or files of any type.

The housekeeping chores involved in shared-disk access on Omninet are somewhat greater than PCnet I requires. To organize users and their assigned volumes on a network, assign specific access levels, and permit the coexistence of up to sixty-three operating systems

and computer types requires nine separate tables. Figure 3 shows the locations of these tables on a daisy-chained drive system.

Disk sharing involves more than just the maintenance of just volume-user access relationships. Another aspect (discussed last month in our review of PCnet I) is concurrent access. All of the operating systems *Constellation II* supports are single-user systems. Therefore no protection against concurrent access is provided at the individual operating-system level. *Constellation II* provides a set of routines that can be accessed from some application programs to lock and unlock hard disk files.

Operating System Interface. A Corvus hard disk driver is integrated into PC-DOS in such a way as to minimize interference with normal operating system functions. Unlike CP/M-86, version 1.1 of PC-DOS has no provisions for user-installed drivers; since there are no specific procedures to be concerned with, the DOS-driver interface is done at the lowest level possible. In other words, the user should never be aware of the driver's presence.

The driver software must do three things: preserve its transparency to the user, send Corvus drive and transporter commands in a machine-independent manner, and read and change the mount table. For each volume accessible to the user, the mount table lists the disk server number, a drive number, the physical limits of that volume on the disk, and the read/write protect status. As you'll recall from table 1, each user maintains his own mount table. PC-DOS uses volume designations A: through J:; other operating systems use other conventions. Part of the job of the drive access table is to strip away operating-system-dependent volume naming conventions.

Network Operations (under Constellation II). Since we've said little to this point about the movement of data around the network, let's take a moment now to explain the more communications-oriented functions of *Constellation II* software as it runs under Omninet. When a device powers up on the network, it sends a "Hello" message to announce its presence to all other active devices; in this message, it transmits its host number, device type, and name. In addition, any device on the network can query any other device with "Who are you" and "Where are you" message packets; the response is a "My I.D. is" message, which is virtually identical to the "Hello" message. If the query is by device type, only devices of that variety respond; otherwise, all devices respond. Network management software uses these messages to determine the network's configuration and status.

Transporter Operations. Device addressing within Omninet's local network allows a message to be sent to any device attached to the network or to all devices on the network. In addition to device addressing, Omninet sup-

Figure 3. OMNINET TABLE ORGANIZATION

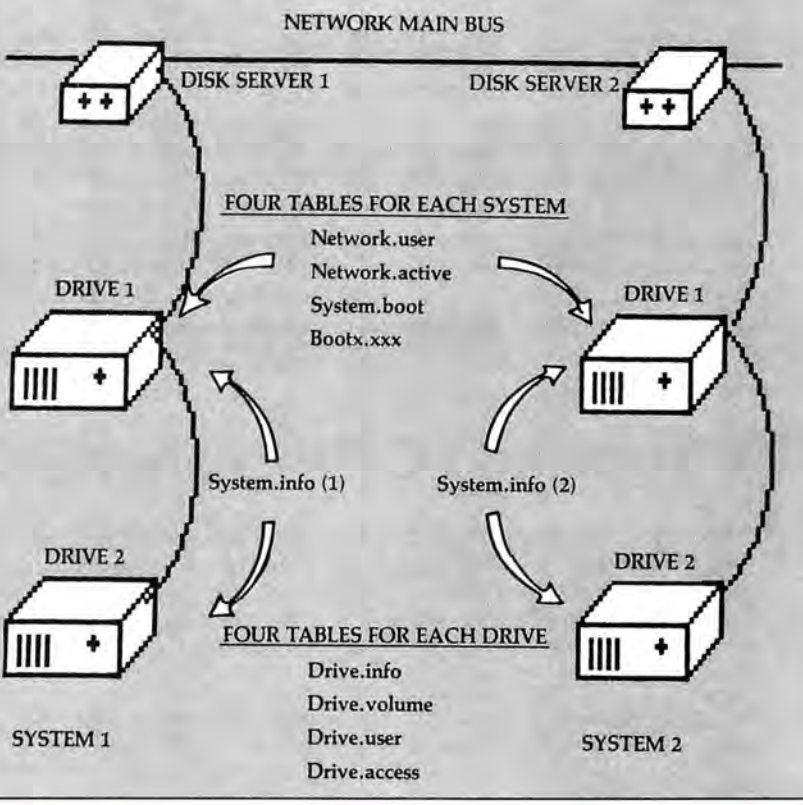
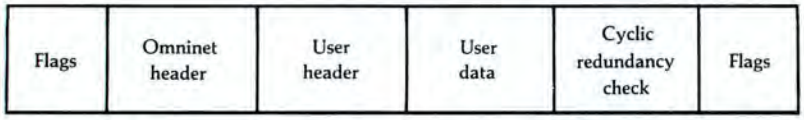


Figure 4. OMNINET DATA PACKET



ports the concept of a socket. A socket provides additional addressing capability by allowing a message to be sent to a particular buffer in the host computer. Up to four sockets can be defined for each computer on the network. With appropriate host-computer software, the socket concept can be very powerful, particularly in a multitasking environment.

To control the overall flow of messages within the local network, the transporter accepts two major types of commands from the host computer. These types are *send message* and *receive message*.

An Omninet message contains two fields that are accessible by the host computer: user data and user header (see figure 4). The user data field may be up to 2,047 bytes long, the user header up to 255 bytes. A send message command specifies a result and a header address, a destination host number, destination socket number, data address and length, and a header length.

The transporter transfers the message and optional message header via DMA, without further involvement of the host software. When a message reaches its destination, one of the following four results is sent back to the sender: *message delivered successfully, message failed after n retries, receiving socket not set up*, or *message too long for receiving socket*.

Receive message commands prepare host sockets to receive incoming messages. Each *receive message* command specifies a result address, a socket number, a data buffer address, and maximum message length. The optional user header length is also specified. When this optional header is used, the header and the actual message can be placed into separate locations in the destination host's memory.

Omninet and Constellation II Configuration

We've now covered the elements of Omninet and *Constellation II* in enough detail to give you the background necessary to understand

Table 2. SUPPORT PROGRAMS FOR THE SYSTEM MANAGER

Drive Manager
- Lists drives on line. Lists the drive number and capacity of all drives on line. Indicates if drives are not initialized.
- Lists volumes. Lists the name, address, length, and operating system of all volumes on the specified drive. Lists all unused space on the drive.
- Adds a volume to a drive.
- Removes a volume from a drive.
- Lists free space on all drives.
- Specifies degree of system-wide access.

User Manager
- Lists user name, password, boot type, and home system.
- Removes users from user directory.
- Adds users to user directory.
- Changes user information.

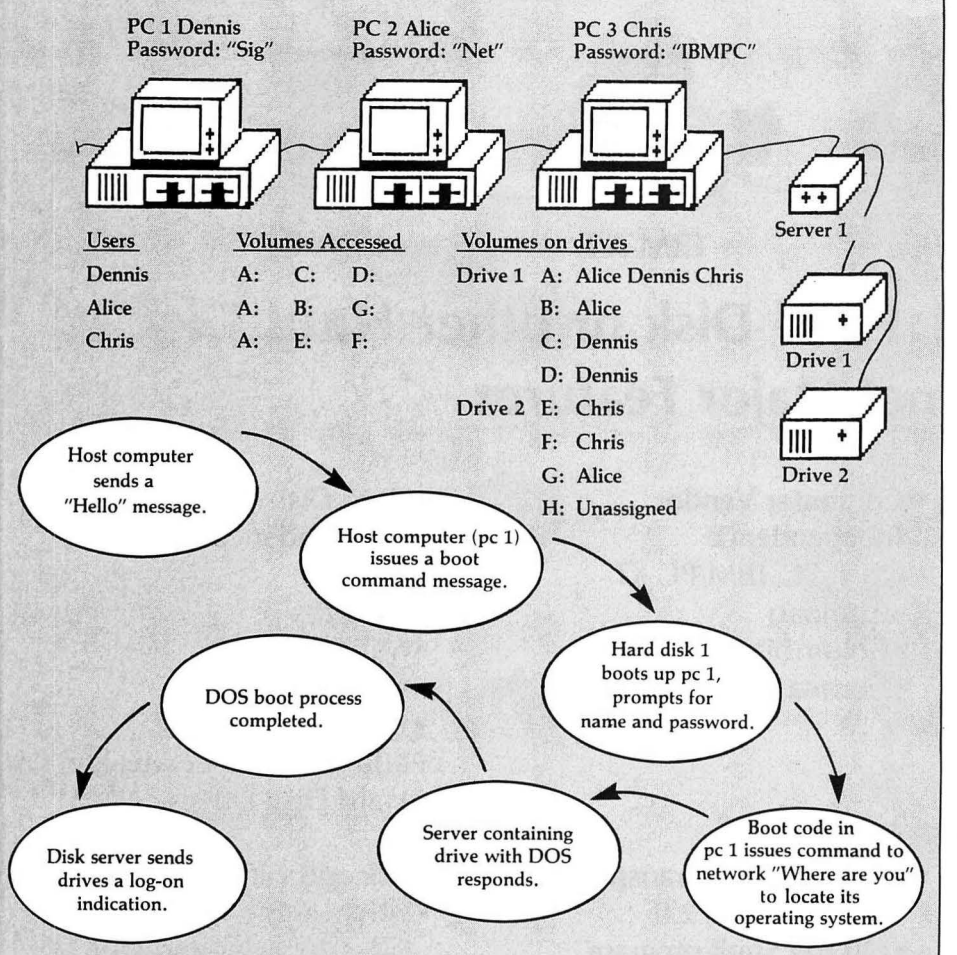
Access Manager
- Specifies user access to several volumes.
- Specifies volume access for several users.

Boot Manager
- Lists file names and CPU types for all boot files.
- Adds boot files to volume.
- Removes boot files from volume.

Table 3. SUPPORT SOFTWARE FOR THE INDIVIDUAL USER

Mount Manager
- Lists drives on line (same as drive manager function).
- Lists volumes accessible to this user.
- Mounts a volume.
- Unmounts a volume.
- Saves mount table.
- Changes user's password.
- Specifies individual access privileges.

Figure 5. NETWORK INITIALIZATION PROCESS



The process for pc 2 and pc 3 is similar.

how this networking system operates. Because Omninet is conceptually more difficult than PCnet I, it makes sense to consider a specific example of network setup, logical and physical device assignments, and representative data transfer events. In the example we'll look at, all the workstations are IBM pcs, but the operating systems are not all the same. This may not be the most practical setup, but it serves to illustrate the general functioning of a network configured for different operating systems.

Figure 5 illustrates our example network and shows the sequence of events that results in the initialization of the network. To start with, the Corvus disks and the disk server are powered up, but no pcs are yet on line. In this example, user Dennis on pc 1 has volumes on both drives 1 and 2, but his PC-DOS boot program is located on drive 1 only. Remember that all data being transferred follows the message conventions described earlier.

Assuming that users Alice and Chris on pcs 2 and 3 boot up in the same manner as user Dennis on pc 1, the network should be ready to operate; all users should be logged on and the assignment of volumes to users made. The volume assignments to drives and users would have been made at an earlier session by means of the installation program.

From this point on, one user should be designated the system manager, responsible for drive, user, access, and boot management. Table 2 lists the various aspects of the system manager's responsibilities.

The system manager support software runs in the UCSD p-System, so if the system manager is using PC-DOS, a change of operating system is required. Typically, the system manager functions are performed during initialization and infrequently thereafter. The individual user is responsible for mount management and the usual file management processes. Table 3 lists the functions of the mount manager software, which is available to each user on the network.

Omninet provides for inter-operating-system file transfer, through the Corvus hard disk pipes scheme. This means that a user whose pc is running under PC-DOS can communicate with another user pc running the p-System. Or with someone on yet another type of personal computer supported by *Constellation II*. The example in figure 5 is meant to illustrate how users with different operating systems might coexist on the same network. It is not meant to suggest that the use of different operating systems is desirable.

Applications supported by Omninet are very similar to those described last month in our discussion of PCnet I. The tie-in to a mainframe computer from Omninet would not be as straightforward as it was in the PCnet I case. No communications server for Omninet is yet available, although such a device will be a future enhancement of the system. If a modem were attached to a single pc on the network, a mainframe link could be set up, but the usefulness of such a scheme would be limited. No provisions are made in Omninet for remote command execution on another pc in the network. The use of a communications server, however, would make such applications relatively easy to set up.

Omninet Costs. To estimate Omninet installation costs, refer to the network shown in figure 1. This system would require eight transporters at $495 each, about two hundred feet of twisted wire at eight cents per foot, one hard disk server, and at least one Corvus hard disk. Total cost would be about $4,875 plus hard disk.

Next month: Ethernet. ▲

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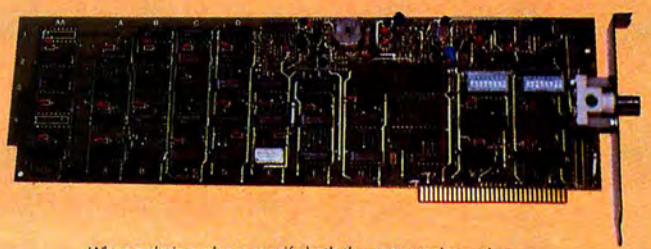
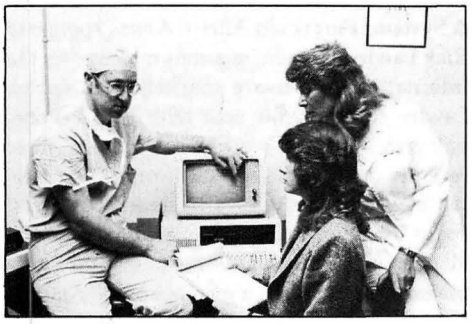


When ordering, please specify both the computer/operating system and the hard disk/version. Orchid supports many different combinations and is adding new configuarations each day.

tradetalk

Δ **Management Science America** (Atlanta, GA) has purchased **Edu-Ware Services** (Agoura, CA) for $1.5 million in MSA stock plus a deferred cash percentage of future profits, according to **Steven Pederson,** Edu-Ware president. "We're very, very happy about the acquisition because we like the people at MSA so much. Working with them will do a lot for us personally, professionally, and economically," he says. "Essentially, we now have the backing of the world's largest independent software manufacturer." The company will now be hiring a number of new programmers in a push to expand new product development. Future plans may include a cooperative effort with MSA's Peachtree Software division and a more competitive marketing approach. "We are going to play to win in the educational market," says Pederson.



The IQARM system at Serra Hospital.

Δ The two-hundred-sixty-four-bed Serra Memorial Health Center (Sun Valley, CA) has installed a pc that reports on patient care and medical staff performance, using a software system designed by **Executive Interface Corporation** (Los Angeles, CA). The consulting firm has provided the hospital with more than a dozen separate programs to document the quality of patient care and physician performance. The computerized IQARM system, based on the hospital's Quality Assurance Management operation, provides the medical staff's Credentials and Ethics Committee with sufficient data to make appointments and reappointments on the basis of each staff member's performance. According to Ermanno Mariani, chief executive officer for the hospital, "It also provides timely renewal of license, Drug Enforcement Agency, and cardiopulmonary resuscitation credentials on each staff member." Selecting and reviewing a physician's performance is now a legal requirement, Mariani adds.

Δ **Datatron** (Tustin, CA) has announced the signing of a letter of intent to acquire **Wayburn** (Garden Grove, CA), a major southwestern hardware and software distributor. The agreement—signed by Datatron president S. Lewis Meyer, Wayburn president Dan Crooks, and approved by Wayburn's board of directors—culminates a lengthy search by Datatron for a suitable microcomputer distribution vehicle for their Interactive Video System. The acquired company will operate as a wholly owned subsidiary.

Δ A twenty-five-year veteran of the information industry has been named president of **PC Telemart** (Fairfax, VA). **Howard I. Morrison** is "that rare individual with wide experience in the computer and data processing industry, and with proven talents in management and marketing," says Larry Stockett, founder of the company. Most recently, Morrison served as senior vice president of DataCom Systems, a computer services organization. He was also president of Arthur D. Little Systems, handling marketing and business development.

Δ **Micro Focus Group** (Palo Alto, CA) has announced the appointment of **Roger D. Friedberger** to the position of financial controller for the company's European branch, **Micro Focus Group** (London, UK). Friedberger, thirty-two, will be responsible for internal financial and management accounting as well as the financial planning of the company's growth. Before joining, Friedberger was controller at Sequential Circuits, an electronic music synthesizer manufacturer.

Δ National Basketball Association stars **Julius "Dr. J." Erving** and **Larry Bird,** as well as celebrated cartoonist **Gahan Wilson,** have been signed by **Electronic Arts** (San Mateo, CA) to help design computer game software to be released later this year. The company has entered the IBM marketplace with the release of two games; educational, personal management, and other software is on the way. Bird plays for the Boston Celtics and Dr. J. for the Philadelphia '76ers. Their rivalry is intense, and they are delighted at seeing it continue electronically. They are helping program designers capture their moves and strategies in a home-computer basketball game using the players' images. Wilson is working with designers to develop entertainment software embodying his imagination and unique dark humor. "I am delighted at how well Electronic Arts and I are working together," says Wilson, author of many children's books. "I can't wait to see what happens next."

Δ **IDE Associates** (Bedford, MA), a major designer and manufacturer of add-ons, has arranged for its secqnd round of venture capital financing of $2.6 million through Techinvest II, the venture capital arm of Houston Industries Trading (Houston, TX). **Gautam Gupta,** chairman and president of IDE, says the investment is Techinvest's first in the high-tech field. Notwithstanding its name, its previous activities have been limited to oil and gas and real estate ventures.

Δ Another add-on manufacturer, **AST Research** (Irvine, CA), has announced the ap-

pointment of **John Mixer** as dealer sales administrator for the western region. Mixer brings nine years of sales management experience to his new post. His last position was national sales manager for the products division at Orange Micro. Δ **Patrick Hart** has been appointed director of international marketing at the company. Hart's primary responsibility will be the establishment of an international distribution network following IBM's thrust into Europe with the pc. His background includes eight years' experience in sales and consulting in data processing, with two years on assignment throughout Europe.

Δ **Ken McGibbon** has been appointed European sales and marketing manager for **Designer Software** (Houston, TX). His appointment is part of the company's continuing campaign to capture a larger share of the overseas market. Replacing a network of European contacts, McGibbon will demonstrate firsthand the capability of the company's *Palantir* word processor package.

Δ **General American Life Insurance** (Saint Louis, MO) has entered the software development arena with *Mike*, a computerized Medicare claims system for physicians. The company is currently entertaining offers to market the package. *Mike* is now available to all Medicare Part B providers in the areas the company serves.

Δ **Systems Plus** (Palo Alto, CA) has appointed **Rick Lawler** as media relations manager for the international software marketing company. Lawler comes to his post after five-and-one-half years' editing weekly newspapers, most recently in Los Gatos, California. His freelance writing includes articles in *Westways*, *Sales & Marketing Management*, *Young World*, *General Aviation News*, and other magazines. He is also a member of the Authors Guild and National Writers Club and is listed in the fourteenth edition of *Who's Who in California*.

Δ The founder of the *Zork* User's Group, **Michael R. Dornbrook**, has been named product manager for entertainment software at **Infocom** (Cambridge, MA). The twenty-thousand-member user group will be discontinuing service as Dornbrook becomes fully responsible for all product support. Dornbrook got his start with the company when he began testing games and answering player inquiries.

Δ **Software Libraries** (Pasadena, CA) has appointed a network of regional sales representatives to implement national marketing of its business and accounting management line of software. The network will immediately serve all major population centers, covering some 85 percent of the U.S population through its initial fourteen appointees. Among the reps are C.P. Marketing (Hayward, CA), Earland Brown (Portland, OR), SmartStuff (Saint Louis, MO), First Delta Group (Bensenville,

IL), and J.A. Thall Company (Valley Stream, NY). The training of store personnel and implementation of incentive campaigns will be among the regional reps' duties under the new contract situation.

Δ A new manufacturing plant has been built in Hong Kong by **Varian Associates** (Palo Alto, CA), bringing the company's worldwide total to seven. The new plant will initially supply magnetic components used in power supplies and memory boards to Far Eastern branches of U.S. computer and telecommunications manufacturing companies. The plant is expected to supply European and U.S.-based manufacturers with components in the near future.

Δ The formation of **Summa Software** (Beaverton, OR) has been announced by its president, **Paul C. Chang.** Chang, who was formerly business analysis manager for Tektronic U.S. field operations, described the company's business plan as "realistic and extremely aggressive." Chang plans to put one hundred different application packages on the market by the end of 1986. Among the company's key executives is **Henry H.C. Wang,** formerly manager of computer-aided manufacturing for Tektronic. A former programmer and analyst with Tektronic, **Jon Kirwin,** has joined as director of systems development. **Ann C. Andrews,** formerly a top-level consumer marketing and advertising executive with Hirsch Weis, comes aboard as director of marketing. She spearheaded the success of Speedo brand swimwear and activewear at her former post.

Δ In the grand tradition of the Oscar, Emmy, and Grammy, **Softsel Computer Products** (Inglewood, CA) will present the industry's first Hot List awards for excellence in personal computer software. The awards, to be presented at the fall Comdex, will honor publishers for outstanding achievements in sales, packaging, performance, and innovation. Sales awards will be based on the distributor's top one hundred Hot List.

Δ The educational program publisher **PDI** (Greenwich, CT) has announced the completion of a study to determine the effects of its computerized teaching aids on preschool children. Twenty children, ages three and four, all from the same socioeconomic background in Stamford, Connecticut, were chosen as subjects for the study. The preschoolers were tested after two months. A gain of 47.4 percent was recorded for the computer-aided group versus a gain of only 13.5 percent for the control group.

Δ **The Interface Group** (Needham, MA), a leading producer of conferences and expositions, has appointed **Lewis R. Shomer** to the position of vice president of marketing and sales. Shomer has twenty years of computer industry experience, including stints at IBM, Honeywell, and Novation. ▲

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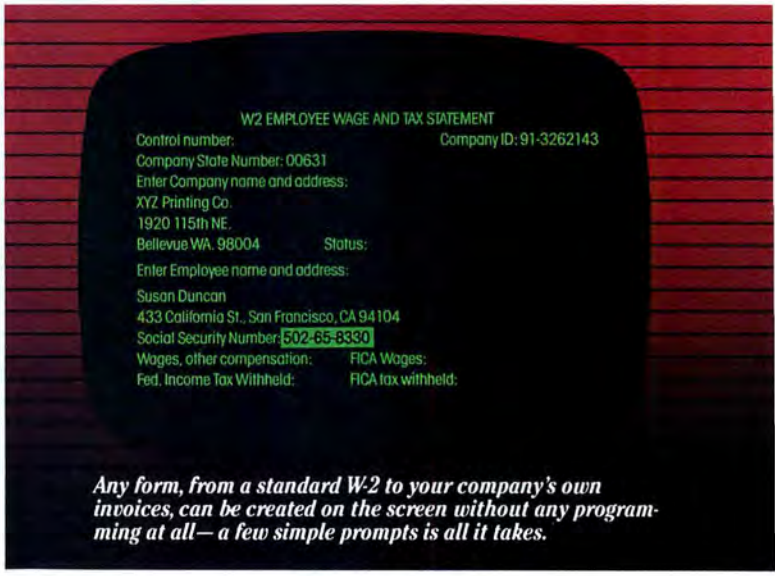
Not only that, R:base is much simpler to use and learn. So your applications are up in days, instead of weeks. And anyone—computer literate or not—can enter and view data, and generate reports. Just what you would expect from a second generation product.



Any form, from a standard W-2 to your company's own invoices, can be created on the screen without any programming at all—a few simple prompts is all it takes.

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With R:base, it's simple. A series of prompts guides you every step of the way. Which means you don't have to be a programmer to create data entry or report forms just like the ones you're used to using.

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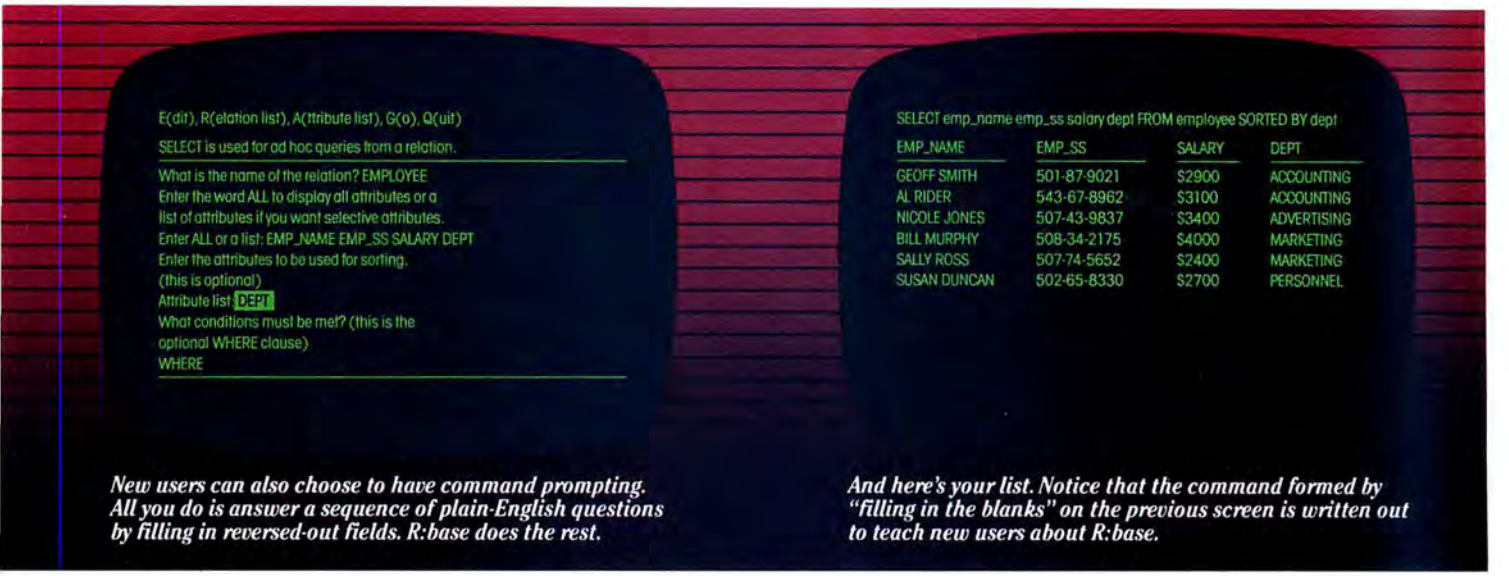
R:base is also very forgiving. It's very hard to make a mistake. That's because commands are simple English expressions—like SELECT, PROJECT, WITH, WHERE, FROM, etc. Dates and dollar amounts are written normally: 11/16/83;

	MAXIMUM RECORDS/ DATABASE	*FILES AVAILABLE CONCURRENTLY*	*MAXIMUM NUMBER FIELDS/ DATABASE*	*TIME TO SORT 1000 RECORDS* (MIN: SEC)*	*UPDATE MULTIPLE FILES CONCURRENTLY*	*PRICE (LIST)*
R:BASE 4000	100 billion	40	400	0:59	Yes	$495
dBASE II	65,535	2	32	5:47	No	$695
CONDOR	32,768	2	127	2:03	No	$650

*Sort 1000 records on 1 key value. (IBM PC with 256K and DS/DD diskettes)

PURCHASING dBASE II,™ THIS FIRST.



New users can also choose to have command prompting. All you do is answer a sequence of plain-English questions by filling in reversed-out fields. R:base does the rest.

And here's your list. Notice that the command formed by "filling in the blanks" on the previous screen is written out to teach new users about R:base.

$500.00. And, because data entry verification rules are defined up front, you just can't put any "garbage in"—even if you try!

What's more, R:base allows you to sort and select data on up to ten different criteria, perform totals, and then display the results—all with a single, powerful command (see screens).

QUESTIONS? ASK FOR HELP.

The R:base HELP feature provides detailed information that describes every command and process required for complete mastery of the database. (As does our plain-English documentation.) For example, if you're not sure what SELECT does, simply key in HELP SELECT and R:base will tell you what the command does, how it works, even the proper syntax. This way you don't have to keep referring back to the user manual—it's all right there in front of you.

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R:base™ 4000 is a single-user relational database (MS-DOS™ version is list $495). R:base™ 6000 is a multi-user version, available early 1984. In addition to MS-DOS, both packages will also be available in CTOS,™ with UNIX™ to follow.

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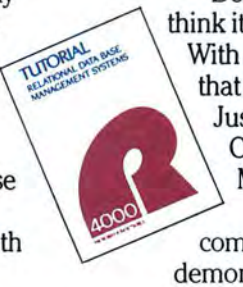
And what happens if you've already got dBASE II? Not to worry. It's easy to transfer your files to R:base.

FULL DEMO PACKET, $9.95.



Does all this sound too good to be true? If you think it does, let us prove to you that R:base is for real. With a comprehensive tutorial and demo diskette that will give you convincing hands-on experience. Just call our order desk at (800) 227-6703 (in California, 800-632-7979) and have your VISA or MasterCard number handy.

Better yet, hurry over to your nearest computer or software retailer for an eye-opening demonstration.

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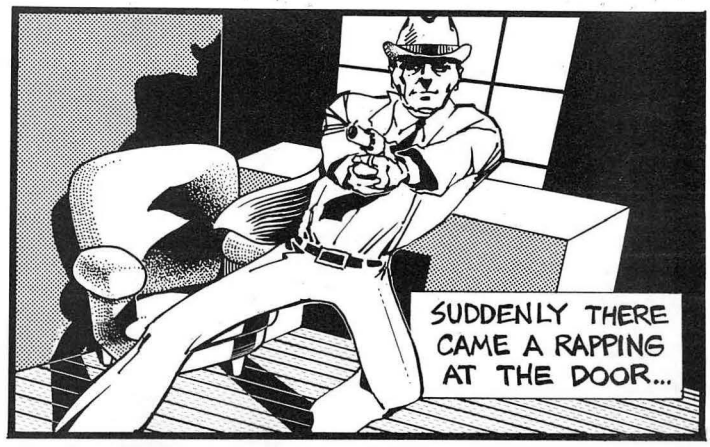
THE MAKE FILE

If you're using any compiler—IBM's Basic compiler, their Pascal compiler, or any other compiler (IBM or not)—you'll find the set of programs given in this article a useful addition to DOS 2.0. These programs, which are grouped together under the name *Make*, add to DOS 2.0 the feature of automatic generation of an .exe or .com file. That is, if your program is separated into a number of different source files, you can, by typing *make*, compile only the files you've changed and link everything together—all automatically.

Illustrations by Kevin McKeon



What's the Make? Make is a powerful utility provided with the Bell Labs Unix operating system. The simple DOS 2.0 version presented here is a distant and poor cousin of the Unix Make, yet it works well enough. Despite its limited power, our DOS 2.0 version knows how to reassemble, or recompile, only the programs you've changed (it can tell which ones you've changed). Let's see an example of how we might use Make.

Say we have a subdirectory somewhere, called Progs, and in this subdirectory we have three assembler files that must be assembled separately and linked:

FILE1.ASM
FILE2.ASM
FILE3.ASM

The first time through, we assemble each file separately, and then we link them together. Thereafter, whenever we change one file, we have to reassemble that file and relink all three.

Three modules are easy enough to manage. Things become somewhat painful, however, if we start adding more files to the program. If we change several files but forget which, we have to check the date and time on each file, then reassemble (or recompile) any file whose source version is more recent than its object version. Under DOS 1.1 there's no other way.

But under DOS 2.0, we can have Make do all the work. Here's how.

DOS 2.0 provides a way for programs to pass a single number back to the operating system. This number is known as an error-level number. The batch file *Makefile*, which we'll create presently, uses an *if errorlevel* statement to test these for error levels. An assembly language program called Cmp_date, which we'll also create in a moment, compares the time and dates of pairs of files and returns an error-level number telling DOS—and thereby Makefile—the result. Makefile simply reassembles any source file whose date is more recent than its corresponding object file.

Fixing the Time. Here is where the assembler program Cmp_date.com enters the scene. When we type

CMP_DATE file1 file2

Cmp_date checks the time and date of file1 and file2 to see which is more recent and returns the following error-level numbers to DOS:

0 **file1 is older than file2**
1 **file1 is newer than file2**
2 **file read error (one of the files doesn't exist, etc.)**
3 **no file on command line (happens when you type CMP_DATE, without specifying file names).**

Cmp_date is the heart of Make, and listing 1 is a Basic program that generates the file Cmp_date.com from a list of numbers in data statements. Later we'll see how Cmp_date does its job, but first let's look at the three batch files that together form Make.

Assembling the Suspects. Make.bat, the first file on the scene, does the preliminary work. First it turns off the echoing of batch commands so we don't see reams of batch instructions as Makefile.bat runs through its task. Then Make calls Makefile, the second batch file, and presents Makefile with a list of source files we want assembled or compiled. Makefile reads these file names, one at a time, until it sees the name "%"—the end marker. But since % has special meaning in batch files, we need to write it twice. The last line, which is a label, prevents DOS from turning echo back on—a rather strange quirk in DOS 2.0 batch files. Here's what Make.bat looks like when the source files are File1, File2, and File3.

```
echo off
makefile file1 file2 file3 %%
:end
```

Makefile, the detective, is the batch file that does all the work, checking dates and times to see which source files need to be recompiled.

Makefile checks the two files (%1.asm and %1.obj here) to see if the object version exists; if it does exist, Makefile checks to see which version is newer. If the .asm file is newer (error level 1), Makefile assembles the file %1.asm. Then it uses shift to set %1 to the name of the next file in the list, and then it checks this next file. For more details, see the section in your DOS 2.0 manual on batch files (pages 6-28 through 6-49).

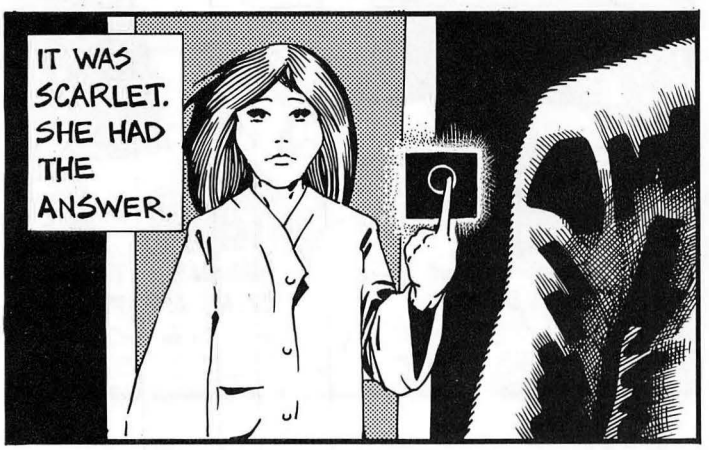
Here is a listing of Makefile.bat:

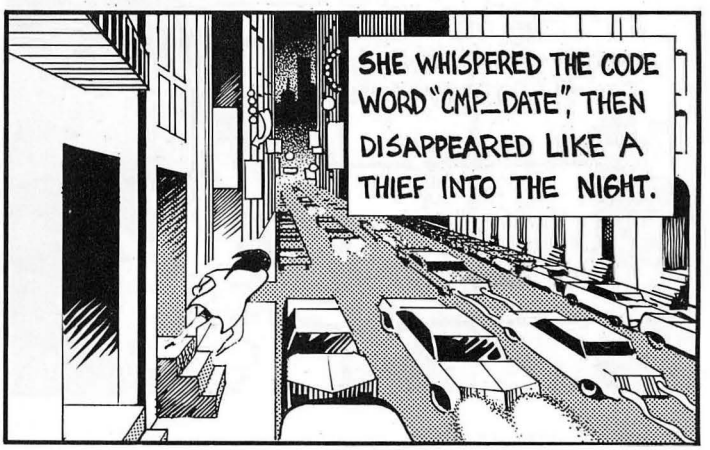
```
echo off
:loop
if %1 == %% goto link
if not exist %1.asm goto nofile
if not exist %1.obj goto asm
cmp_date %1.asm %1.obj
if not errorlevel 1 goto do_shift
:asm
echo Assembling %1
masm %1;
:do_shift
shift
goto loop
:link
linkfile

:nofile
echo File %1.asm does not exist
```

To use this batch file with a compiler (rather than with the assembler), change the ".asm" in the fourth, sixth, and last lines to ".pas", or whatever you use as the extension for source files. Then change the line *masm %1;* to the line you'd type to compile a file %1. You'll also want to change the line *echo Assembling %1* to *echo Compiling %1.* That's all you need to change.

Finally, we use Linkfile.bat to link everything together. The version shown here creates a com file (hence the call to the DOS program Exe2bin) from a group of assembler programs. Change this file to link the programs for the compiler you're using; just type the *link* command as you would from DOS for the compiler you're using.





Here's Linkfile.bat:

```
echo on
link file1+file2+file3;
exe2bin file1 file1.com
```

Our trio of batch files is written for an assembly language program built from the three files file1.asm, file2.asm, and file3.asm. These three files are named in Make.bat and Linkfile.bat, and the reference to the assembler is in Makefile.bat, where we add the .asm suffix to the names and use the line *masm %1* to assemble the files. You'll have to change these files for each program you're working on.

By placing specific versions of the three Make files in their own subdirectories along with the files for each project, you can arrange things so you just have to type *make* to rebuild your program. Then when you want to work on a different project, just switch to its subdirectory with a different version of the Make files. This method works very well on a hard-disk system where there is enough room to store all the source files for different projects and different compilers. But it also works well enough on floppy-based systems where different projects reside on different disks.

Building the Case. The program to compare the dates of two files, called Cmp_date.com, is a machine language program written for DOS 2.0. If you try running this program from DOS 1.1, you'll just get an error message saying that you can't run Cmp_Date under versions of DOS before 2.0.

Here is the Basic program to generate Cmp_Date.com. Enter and run it once to build Cmp_date. If you make an error entering the data, this Basic program will tell you which data statement is wrong.

```
10 DIM CHECK(27)
20 FOR I=1 TO 27 : CHECK(I) = 0 : NEXT I
30 PRINT "Checking";
40 FOR I=1 TO 27
50   FOR J=1 TO 8
60     READ BYTE
70     CHECK(I) = CHECK(I) XOR BYTE
90   NEXT J
100    PRINT".";
110 NEXT I
120 PRINT
130 LINECHECK = 0
140 FOR I = 1 TO 27
150 READ CHECK
160 LINECHECK = LINECHECK XOR CHECK
170 IF CHECK(I) <> CHECK THEN PRINT "Data in Line";1000+10*(I-1);"may be bad."
180 NEXT I
190 IF LINECHECK <> 192 THEN PRINT "Data bad in lines 2010-2040."
200 OPEN "cmp_date.com" AS #1 LEN=1
210 FIELD #1,1 AS BYTE$
220 RESTORE
230 FOR I=1 TO 216
240    READ BYTE : LSET BYTE$ = CHR$(BYTE) : PUT #1
250 NEXT I
260 CLOSE
270 PRINT "CMP_DATE.COM created"
280 END
```

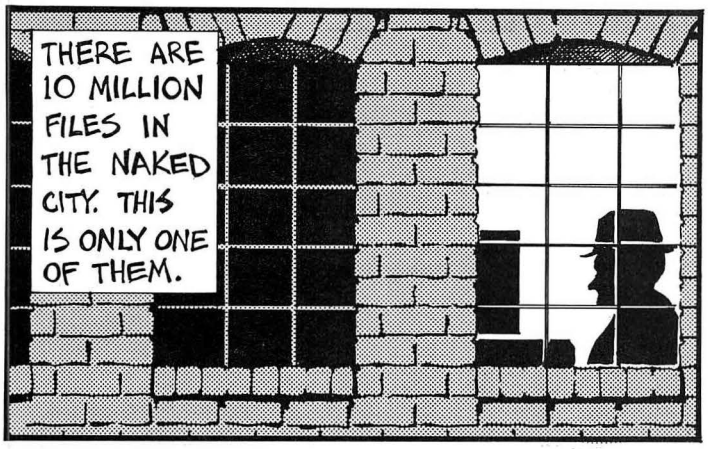
```
1000 DATA  180,  48,  205,  33,  60,  2,  115,  9
1010 DATA  180,  9,  186,  174,  1,  205,  33,  205
1020 DATA  32,  186,  215,  1,  232,  64,  0,  227
1030 DATA  54,  232,  122,  0,  60,  255,  116,  51
1040 DATA  137,  14,  168,  1,  137,  22,  170,  1
1050 DATA  186,  215,  1,  232,  41,  0,  227,  31
1060 DATA  232,  99,  0,  60,  255,  116,  28,  57
1070 DATA  22,  170,  1,  119,  14,  114,  6,  57
1080 DATA  14,  168,  1,  119,  6,  50,  192,  180
1090 DATA  76,  205,  33,  176,  1,  235,  248,  176
1100 DATA  3,  235,  244,  176,  2,  235,  240,  80
1110 DATA  87,  86,  252,  139,  54,  172,  1,  139
1120 DATA  250,  51,  201,  172,  60,  32,  116,  251
1130 DATA  60,  9,  116,  247,  78,  172,  60,  13
1140 DATA  116,  12,  60,  32,  116,  8,  60,  9
1150 DATA  116,  4,  170,  65,  235,  239,  50,  192
1160 DATA  170,  78,  137,  54,  172,  1,  94,  95
1170 DATA  88,  195,  180,  61,  176,  0,  205,  33
1180 DATA  115,  3,  184,  255,  255,  195,  83,  232
1190 DATA  240,  255,  11,  192,  120,  8,  139,  216
1200 DATA  180,  87,  50,  192,  205,  33,  91,  195
1210 DATA  0,  0,  0,  0,  129,  0,  67,  97
1220 DATA  110,  110,  111,  116,  32,  117,  115,  101
1230 DATA  32,  119,  105,  116,  104,  32,  68,  79
1240 DATA  83,  32,  118,  101,  114,  115,  105,  111
1250 DATA  110,  115,  32,  98,  101,  102,  111,  114
1260 DATA  101,  32,  50,  46,  48,  48,  36,  0
2000 '
2010 DATA  44,  137,  7,  32,  26,  81,  25,  137
2020 DATA  144,  178,  229,  102,  63,  101,  45,  109
2030 DATA  247,  78,  176,  231,  101,  163,  88,  9
2040 DATA  103,  65,  125
```

The Autopsy. Time to roll up your sleeves; here is where we'll see the inner workings of Cmp_date. If you're not interested, then just skip to the next, and last, section.

Cmp_Date is a somewhat modular program with the main program and three procedures. The first procedure, Get_command_line_arguments, reads the command line to see what you've typed (with the batch file Makefile) after "Cmp_date". For example, file1.asm would be the first argument on the command line "Cmp_date file1.asm file1.obj" and file1.obj would be the second argument. Get_command_line_arguments places the next name into the variable File_name_string with a hex 00 at the end; this is known as an ASCIIZ string, since we've placed a hex 00 at the end. So the first time Get_command_line_arguments is called, File_name_string will be set to "file1.asm", while the next time it will be set to "file1.obj". This is how Cmp_date gets the names of the two files. There is also some error checking in case fewer than two file names appear after "cmp_date"; you'll find the error checking in the listing.

Once a file name is in File_name_string, Read_date_time calls Open_file, which opens a file, using the DOS 2.0 function 3D hex. This is a new way to open files, and it's more convenient than the old way available under DOS versions before 2.0. With this method of opening files we can easily find the date and time a file was last changed.

Here is where the last procedure, Read_date_time, enters the



scene. This procedure uses another DOS 2.0 function call, 57 hex, which returns the date and time of a file we just opened with Open_file. Read_date_time calls Open_file, then requests the date and time for the file just opened. You'll find the details in the listing, and you can get more information on the DOS function calls in Appendix D of your DOS 2.0 manual.

The rest of the program is straightforward. Just have patience and plow through the listing if you want to see all the gory details.

The Trial. Unfortunately there is one disadvantage of this version of Make: It doesn't stop if there happens to have been an error in the assembling or compiling of some program. There's a very good reason why it doesn't: Almost no compilers for DOS return error-level numbers, so there is no way for these batch files to know when a compiler has run into problems with a program. That will probably change soon as compiler manufacturers see the advantage in returning an error-level number.

One compiler manufacturer, Software Building Blocks, Inc., has already modified its SBB Pascal Compiler to return error codes. SBB Pascal returns an error code of 1 when the compiler encounters an error. Here is a version of Makefile.bat modified to compile SBB Pascal programs; this version halts Make if the compiler has encountered an error. The changes to Makefile.bat for SBB Pascal are underscored.

```
echo off
:loop
if %1 == %% goto link
if not exist %1.pas goto nofile
if not exist %1.obj goto compile
cmp_date %1.pas %1.obj
if not errorlevel 1 goto do_shift
:compile
echo Compiling %1
pascal %1,b,b,b
if errorlevel 1 goto errs
p2 %1
if errorlevel 1 goto errs
:do_shift
shift
goto loop
:link
linkfile

:nofile
echo File %1.pas does not exist
goto end

:errs
echo Compilation error(s)—Make aborted
:end
```

The statement *if errorlevel 1 goto errs* stops Make if the SBB compiler has encountered errors in either pass 1 or pass 2.

Other compiler manufacturers have agreed to modify their compilers to return error codes. Check with your compiler company to see if they have a new version that works with the modified Makefile just shown.

Special thanks to Jeff Moskow of SBB for modifying the SBB Pascal compiler.

```
CR              EQU     0DH             ;Carriage return character
TAB             EQU     09H             ;Tab character
SPACE           EQU     20H             ;Space character

;-------------------------------------------------------------------------------
;  The program CMP_DATE.COM compares the last-update date of two files        ;
;  and returns, to DOS versions 2.00 and after, error codes as follows        ;
;                                                                             ;
;  For the command                                                            ;
;                                                                             ;
;          cmp_date file1.ext file2.ext                                       ;
;                                                                             ;
;          0       file1 is older than file2                                  ;
;          1       file1 is newer than file2                                  ;
;          2       file read error                                            ;
;          3       no file on command line                                    ;
;-------------------------------------------------------------------------------
CGROUP GROUP    CODE_SEG,DATA_SEG


DATA_SEG        SEGMENT BYTE PUBLIC 'data'
FIRST_TIME      DW      0
FIRST_DATE      DW      0
COMMAND_LINE_PTR DW     81H             ;Offset into command line
VERSION_MSG     DB      'Cannot use with DOS versions before 2.00$'
FILE_NAME_STRING DB     ?               ;Leave room for long names
                                        ;At end of .com file
DATA_SEG        ENDS


CODE_SEG        SEGMENT BYTE PUBLIC
        ASSUME  CS:CGROUP,DS:CGROUP
        ORG     100H
CHECK_DATE_TIME PROC    FAR
```

```
        MOV     AH,30H                          ;Check DOS version number
        INT     21H
        CMP     AL,2                            ;Make sure it is at least 2.0
        JAE     IS_AT_LEAST_DOS_2
        MOV     AH,9                            ;Write an error message
        MOV     DX,OFFSET CGROUP:VERSION_MSG
        INT     21H
        INT     20H                             ;Return to DOS, version < 2.00

IS_AT_LEAST_DOS_2:
        MOV     DX,OFFSET CGROUP:FILE_NAME_STRING       ;Get first file name
        CALL    GET_COMMAND_LINE_ARGUMENT       ;And put into FILE1_STRING
        JCXZ    NO_FILE                         ;No file names, signal error
        CALL    READ_DATE_TIME                  ;Find the date for this file
        CMP     AL,-1                           ;Check for error condition
        JE      FILE_READ_ERROR                 ;Yes, return error code
        MOV     FIRST_TIME,CX                   ;Save date and time
        MOV     FIRST_DATE,DX
        MOV     DX,OFFSET CGROUP:FILE_NAME_STRING       ;Get second file name
        CALL    GET_COMMAND_LINE_ARGUMENT
        JCXZ    NO_FILE                         ;Signal error if second file
                                                ;  missing.
        CALL    READ_DATE_TIME                  ;And find its date and time
                                                ;Now compare the two times
        CMP     AL,-1                           ;Check for file read error
        JE      FILE_READ_ERROR
        CMP     FIRST_DATE,DX                   ;Compare date first
        JA      FIRST_FILE_NEWER                ;The first file is newer
        JB      SECOND_FILE_NEWER               ;The second file is newer
        CMP     FIRST_TIME,CX                   ;Now try the date
        JA      FIRST_FILE_NEWER
SECOND_FILE_NEWER:
        XOR     AL,AL                           ;Return 0, for no error
RETURN: MOV     AH,4CH
        INT     21H                             ;Return to DOS
FIRST_FILE_NEWER:
        MOV     AL,1                            ;Return level 1 error
        JMP     SHORT RETURN

NO_FILE:
        MOV     AL,3
        JMP     SHORT RETURN

FILE_READ_ERROR:
        MOV     AL,2
        JMP     SHORT RETURN
```



```
CHECK_DATE_TIME         ENDP

;-----------------------------------------------------------------------------
;  This procedure will read the next file name from the command line and place it
;  in the data area at DS:DX
;
;       DS:DX   Data area for file name
;  Returns
;       CX      Number of characters read
;               0 if end of input line
;-----------------------------------------------------------------------------
GET_COMMAND_LINE_ARGUMENT       PROC            NEAR
        PUSH    AX
        PUSH    DI
        PUSH    SI
        CLD                                     ;Set direction for increment
        MOV     SI,COMMAND_LINE_PTR             ;Point to current position in line
        MOV     DI,DX                           ;Point to string destination
        XOR     CX,CX                           ;Start with 0 characters read
SKIP_OVER_WHITE_SPACE:                          ;Skip over the white space before name
        LODSB
        CMP     AL,SPACE                        ;Is it a space?
        JE      SKIP_OVER_WHITE_SPACE           ;Yes, keep skipping
        CMP     AL,TAB                          ;A tab is white space
        JE      SKIP_OVER_WHITE_SPACE
        DEC     SI                              ;Point back to no-white-space character
GET_LOOP:
        LODSB                                   ;Get the next character
        CMP     AL,CR                           ;End of line, and name?
        JE      END_OF_NAME
        CMP     AL,SPACE                        ;End of name?
        JE      END_OF_NAME                     ;Yes, then we are done
        CMP     AL,TAB                          ;End of name?
        JE      END_OF_NAME
        STOSB                                   ;Still part of the name, so save it
        INC     CX                              ;Keep track of the number of characters
        JMP     SHORT GET_LOOP                  ;Get another character in the name
END_OF_NAME:
        XOR     AL,AL                           ;Store a 0 at the end of the name
        STOSB
        DEC     SI                              ;Point to first character after name
        MOV     COMMAND_LINE_PTR,SI             ;And save this new pointer
        POP     SI
        POP     DI
        POP     AX
        RET
GET_COMMAND_LINE_ARGUMENT       ENDP


;-----------------------------------------------------------------------------
;  This procedure opens the file whose ASCIIZ name is given at DS:DX
;
;       DS:DX   String with ASCIIZ file name
;  returns:
;       AX      File handle
;               -1 if there is an error condition
;-----------------------------------------------------------------------------
OPEN_FILE       PROC    NEAR
        MOV     AH,3DH                          ;Open file
        MOV     AL,0                            ;Call for open file for reading
        INT     21H
        JNC     NO_ERROR                        ;There was no error, return 0
        MOV     AX,-1                           ;Return error condition
NO_ERROR:
        RET
OPEN_FILE       ENDP

;-----------------------------------------------------------------------------
;  This procedure returns the date and time of the file.
;
;       DS:DX   String with ASCIIZ file name
;  returns:
;       AL      -1 if there was an error, file handle otherwise
;       CX      Time
;       DX      Date
;-----------------------------------------------------------------------------
READ_DATE_TIME  PROC    NEAR
        PUSH    BX
        CALL    OPEN_FILE
        OR      AX,AX                           ;See if there was an error
        JS      RETURN_DATE_TIME                ;Yes, return with AX = -1
        MOV     BX,AX                           ;Place file handle in BX
        MOV     AH,57H                          ;Get file's date and time
        XOR     AL,AL                           ;Read date and time
        INT     21H                             ;DO IT
RETURN_DATE_TIME:
        POP     BX
        RET
READ_DATE_TIME  ENDP


CODE_SEG        ENDS
        END     CHECK_DATE_TIME
```

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June, 1983

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PC Magazine, February, 1983

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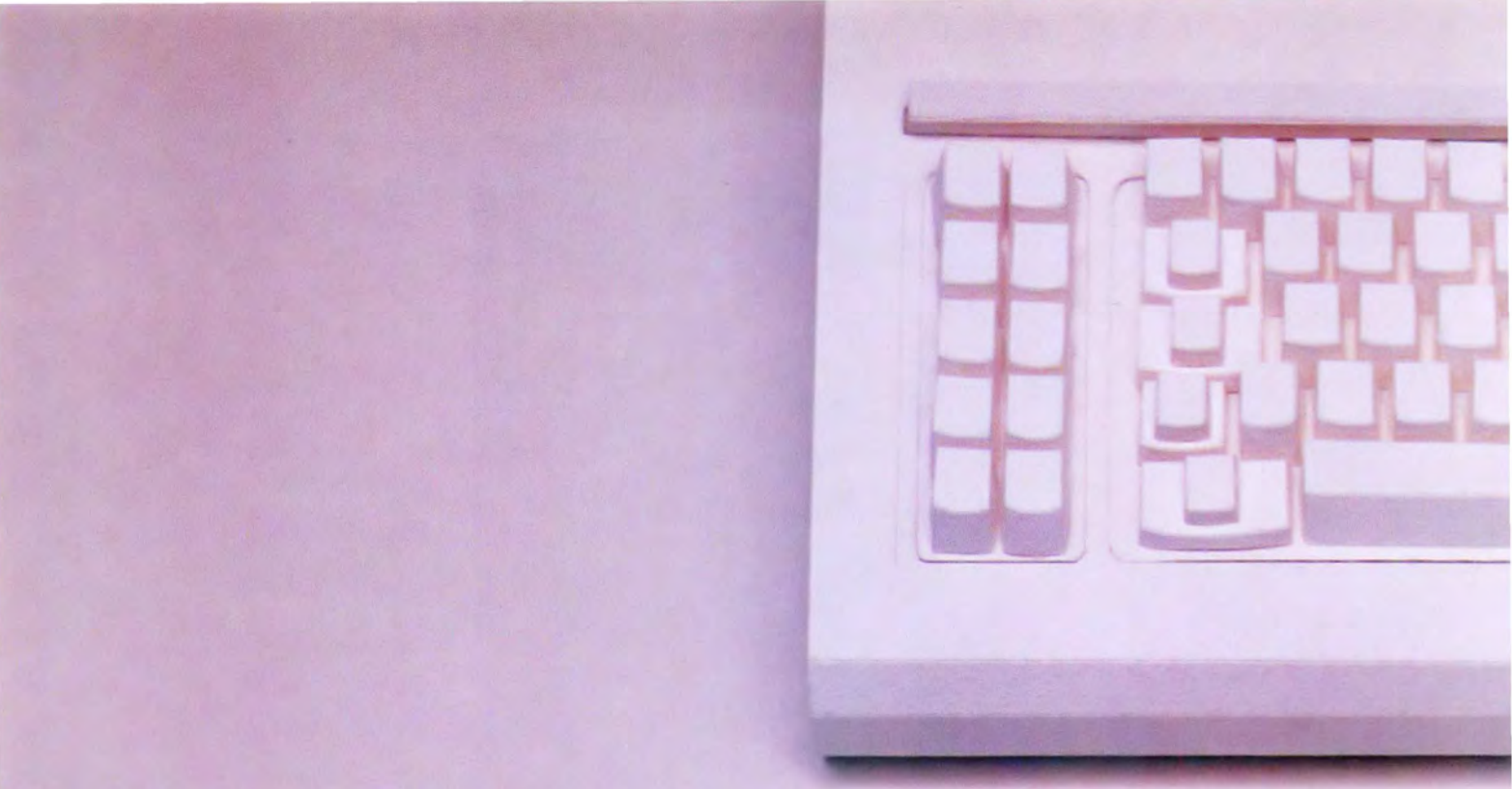

Microsoft's Ro

In June, *Softalk* previewed an exciting new mouse-driven word processor from Microsoft. In the intervening months, Microsoft completed the first versions of its *Multitool Word*. The company has wisely decided to relieve its new baby of a rather clumsy name; the new word processor has been fittingly christened *Word*. What hasn't changed is the program's promise to open up a new era in powerful word processing software.

Because of the strength of the program itself, and because of what it can tell us about the new breed of software, we have decided to review *Word* now, rather than wait until the final version of the program is released. What follows then is a review of the first of the new breed of word processing software designed to take full advantage of sixteen-bit machines such as the IBM pc. The review was conducted on what's called a beta-, or user-test version; for that reason, certain details of the program as described here may not exactly match the final version.

by Kevin Goldstein

dent-Driven Word Processor

Word's first surprise is an extremely pleasant one: Whether or not you have a mouse (the mouse is optional), you'll find that within only ten minutes or so you'll be able to make the program perform useful work. That painless introduction is the consequence of two elements: the way the user interface is implemented and the fact that the mouse is thoroughly integrated into the design of the program.

Much like IBM's new *Personal Editor*, and unlike such older programs as *WordStar*, *Word* can be thought of as having two operational modes: a command mode and a text mode. And like *Personal Editor*, *Word* allows you to move from text mode (*Word* calls this alpha mode) to command mode by pressing the escape key. Doing so highlights a command bar in the command menu; at that point, you can select any of the displayed commands, either by moving the command bar or simply by typing the first letter of the command. This user interface is modeled after the one in Microsoft's popular *Multiplan*, and it's just as easy to use. Actually, if you've got a mouse, it's even easier to use: Simply point to any command in the menu at any time—even when you're in text mode—hit a mouse button, and the command will immediately be executed. That's a good example of how the mouse cleans up and simplifies the entire interface, in this case making the transition between the two modes practically transparent.

The mouse lets you perform functions almost immediately that would otherwise require more time to learn. With the mouse driver routine installed (the routine must be installed before you enter *Word*), *Word* displays two cursors: a smaller blinking mouse cursor, and an inverse video shape that functions as the active cursor; the active cursor indicates where your next keystroke will appear. (Cursor shapes vary between graphics and monochrome modes; all descriptions in this review are of the monochrome mode.) Repositioning the active cursor by means of the mouse is simplicity itself. Just move the mouse until the mouse cursor is in the desired location, then hit

Paper sculpture by Nancy James; photography by Tim Durr

one of the two mouse buttons; the active cursor immediately moves to occupy the same position as the mouse cursor.

The great advantage afforded by the mouse is not merely that it allows easy repositioning of the cursor, however; the mouse makes it just as easy to select text. For example, if you press the right rather than the left button to indicate a new cursor location, the active cursor "expands" to highlight the whole word; you have just selected an entire word, and at the same time you've repositioned the cursor. Punching both buttons at once selects an entire sentence. You can select arbitrary quantities of text by punching a mouse button at one end of the block and holding the button down while moving the mouse to the other end. You can do this in either direction—mark the beginning of the block and move to the end, or vice versa. If your text block runs more than one screen, you can move the mouse to the window border and cause the display to scroll automatically. All in all, it's the easiest method of text selection (text block definition) that's yet come down the pike.

This selection method is the key to text manipulation in *Word*. Selected text can be deleted, moved, entered into the glossary, copied to another point in the same document or to a different document in another window, or tagged with attributes such as boldface or italics (or underline, strikethrough, small caps, or double underline, for that matter). If the selected text is one or more paragraphs—you can select a whole paragraph simply by pointing anywhere within it and hitting both mouse buttons—paragraph formatting commands such as double-space can be applied. There's even a command to open up a blank line between paragraphs.

Selecting text with the mouse gets the job done in a way that's bound to feel a little strange if you're used to more conventional—dare we say old-style?—word processors. In particular, learning to control the cursor with the mouse bears more resemblance to mastering a video game than to learning a word processor; the motor skills required to use the mouse effectively, however, are fairly easily attained.

Right from the beginning it's easy enough to perform operations with the mouse; even so, the novelty of its operation will quite possibly leave you feeling a little uncomfortable for some time. In a paradoxical way, it's the initial ease of use that sets you up for that later uncomfortable feeling. If it were a little harder to use right from the beginning, you would realize that you're learning not only a complex new piece of software, but also an entirely new way of communicating with a computer.

But hang in there, because it is very much worth the effort. After you've lived with the mouse for a while, its use becomes second nature, and it's at that point that you start to realize just how much the little bugger is speeding things up. Whether it's just to move the cursor back a few sentences to make some corrections, or to select whole phrases for copying, the mouse turns out to be truly useful, a fact that strikes home rather dramatically when you start reaching for it in the middle of editing a *dBase* record. Feed it well; you'll want it around for a long time.

Just as there are certain jobs so well suited to "mouseinachinations" that you start thinking of the rodent as a necessity rather than a luxury, so are there tasks for which the mouse is ill-suited. As your mastery of *Word* grows, you realize there are places where using the mouse actually slows things down. Boldfacing the last word you typed is a good example. In this and similar situations, it's easier to punch F7 to "select previous word" than to use the mouse. Moving the cursor forward or backward by just a few words is another good example of a job that can be handled faster right at the keyboard.

Browsing through the manual, you may decide the facilities for keyboard cursor manipulation are incomplete. While the standard cursor control keys—the four arrows, page-up, page-down, home, and end—all work reasonably, at first blush there appear to be no short cuts for such things as moving the cursor forward a word at a time.

Don't be misled. What you will find are function keys that select the next word (F8), previous word (F7), previous sentence, or current sentence; just bang those buttons repeatedly, and you quickly progress by word or sentence forward or backward. There are also keys for selecting paragraphs or lines, although the line-select key requires use of a shifted function key. A lot of thought obviously went into the assignment of operations to the function keys; the result is a set of extremely useful special-purpose keys.

Using selection keys to move the cursor actually has an advantage over a straightforward "move cursor" keystroke: Hitting the right arrow key before you start typing flings the cursor to the end of the selection. That lets you very easily move to either the beginning or end of a word, line, sentence, or paragraph—a small but really convenient operation.

As to the relative merits of command selection via function key versus command selection via control character (as in *WordStar*)—well, you probably know by now that the world is divided into two groups: those who like control-character commands and those who prefer function-key commands. If you're in the latter group, you'll applaud Mi-

crosoft's design; if you're not, you won't. One consolation to the control-character group (who claim that never having to remove fingers from keyboard translates directly into greater speed): *Word*'s most frequently used cursor movement/selection function keys are both unshifted and near the bottom of the keyboard, so a really hot control-keyer can learn to touch-type them.

The real power of *Word* doesn't become obvious until you can fluidly combine mouse manipulations with keyboard operations. At that point, you can do everything fast—always as fast as, in most cases faster than, and in some cases obscenely faster than you can with any other word processor.

See a misspelled word some distance from the cursor? Use the mouse both to position the cursor over the word and to select the misspelling, bang the delete key, and type in the correction. Want to replace the pronoun two words to the left? Tap F7 twice, hit delete, then type in the new word. Decide you like the old word better? Hit escape (to get to the command menu) and U (for *undo*), and the old word reappears. No, you really do like the new word better? Just *undo* again. Want to move a whole sentence? Use the mouse to position the cursor anywhere within the sentence, hit F9 (*select sentence*), hit delete, reposition the cursor, hit escape, and insert.

Once you get comfortable with *Word*, writing with it—and even more especially editing with it, since that activity makes heavier use of *Word*'s unique talents—becomes a delight; other word processors will seem like remnants of the typewriter age.

No matter how good a new program is, there are bound to be some areas where prospective users don't see quite eye to eye with the designers. *Word* is no exception. *Word*'s designers have included what should have been an unmitigatedly delightful feature: If you've printed a document and then gone back in and inserted or deleted text from the document, *Word* keeps track of the old page numbers for you. That means when you make a jump to page number based on the marked-up document, *Word* jumps to the page corresponding to the printed text you're looking at. That's a wonderful feature, but its inclusion presents a conundrum: Should the status line display the page number that corresponds to the last printing of the document, or should it display the page number that would be appropriate if the document were printed now?

Word offers a simple solution: It doesn't display any page numbers at all on the status line. Considering that *Word* has the goodness to include a jump to page command to begin with, this is an absolutely ludicrous solution. What, to offer just one example, of those users who have no printer? (Maybe they send all their writing out via modem? That's not an unlikely occurrence in an office with many small computers.) *Word* carries the cop-out one step further by not displaying page breaks either, unless you turn the style bar on; doing that often forces you to waste the three columns required in the style bar simply to view the page breaks. (The style bar also displays the style sheet formatting codes—to be described presently.)

In a program that attempts to be almost everything to everybody, a new feature should not be included at the expense of an old and useful one. Most of us need a real-time indication of how much we've written, lest we drone on into the night or come up embarrassingly short. The proper answer would seem to be either to display both page numbers on the status line or to let the user choose which number to display.

As long as we're on the subject of complaints: How about a display of the row and column number? The graphic marker that slides up and down the left border indicates the approximate position of the current page within the overall document; a similar status indication is needed to show where you are in the current page.

One of the joys of *Word* is discovering all of its "hot spots"—the positions on the display that are sensitive to the mouse. If you read the sneak preview of *Word* in the June issue, you'll probably recall that the entire left-window border works as a scroll bar. Positioning the mouse cursor on any line of the bar and hitting the right button scrolls the display just enough to move that line to the top; conversely, hitting the left button causes the display to scroll the top line down to the mouse cursor.

A short line on the scroll bar, the "thumb," represents the approximate location of the current page within the entire document; if you were to place the mouse cursor two-thirds of the way down on the scroll bar and hit both buttons, *Word* would move you to the page two-thirds of the way into the document, and the thumb would move down to meet the mouse cursor at that two-thirds point. Moving the thumb in that manner is called, appropriately enough, thumbing; the term is a throwback to the old days when you would manually thumb through a paper document. If you're moving any distance, or you're scanning for a particular section of the document, the scroll bar works especially well.

Anything that can be done with the mouse can also be done without it, and scrolling is no exception. In some cases, the nonmouse alternatives operate quite a bit slower, which still leaves you no worse off than you'd be if you were using a conventional, mouseless, processor. Sometimes (as in the examples mentioned previously) the alternate methods take more time to learn but work faster; those methods can be lumped together into the category of expert-mode operations. The alternate method of scrolling requires toggling the scroll lock key, which causes the cursor arrows to take on the function of scroll keys. That opens up the horrendous possibility—make that certainty—of punching an arrow key to move the cursor and instead watching your whole display scroll out of sight. Manual scrolling is not an expert mode, it's simply a mode to be avoided. Let's hope Microsoft sees fit to offer another way to scroll from the keyboard; a control-arrow keystroke combination, currently unused, comes to mind.

Another mouse hot spot is the upper-right hand corner—positioning the mouse cursor over it and hitting a button turns on the ruler.

The ruler is a pleasure to use. It's marked in inches, with ticks at each tenth of an inch; right margin, left margin, and tab (and decimal tab) stops are graphically displayed. Since cursor position isn't indicated in the status line, one might hope to find it indicated graphically on the ruler line. It's not there.

There is actually a very good reason for not displaying the current cursor column on the ruler. Since *Word* is fully capable of dealing with proportionally spaced character fonts—and at some time in the future will probably even be able to display such fonts directly on the screen (quite likely shortly after IBM an-

nounces an upgraded graphics card with enough resolution to get the job done)—an indication of column position would be useless at best, and simply wrong the rest of the time. For that reason, *Word* has practically abandoned the concept of columns as a measurement of horizontal distance. Now that's good, and it's also bad.

If your writing is going to be passing through a typesetting machine before reaching its ultimate destination, or if it will be printed on a sophisticated laser printer with proportional spacing, dealing with the typesetter-compatible measurements of inches, points, or centimeters throughout the whole writing process might be very useful. *Word* is clearly biased toward the "Page Beautiful" crowd, and using typesetters' measurements consistently should make the interface to fancy printers and typesetting machines much easier. On the other hand, if all you want to do is simply get your thoughts on paper, you're going to miss the simple-minded ease of dealing with columns—one column, one character.

The absence of column indications illustrates *Word*'s bias when it comes to dealing with two conflicting requirements of a good word processor. The first is that the program be designed to interfere as little as possible during the creative phase of writing. The second is that the program have enough power and versatility to handle all those "special situations" that seem to occur so often, as well as to be able to format your final document according to a dizzying array of specifications.

The first requirement demands an easy-to-use interface that allows the writer to develop a certain fluidity of operation. Having to hassle with tedious and difficult methods of cursor control and text manipulation is sure to put a crimp in anyone's thought processes. *Word* is truly a star performer in this important area. With its mouse, its well-designed single-keystroke cursor-movement commands, and its exceptionally easy cut-and-paste methods, *Word* works for you rather than against you.

The second requirement necessitates a whole train of exception processing and ways to deal with unusual or complex situations. Unfortunately, the program's attempts to meet this requirement (which it nevertheless meets better than most other currently available word processors) occasionally fall short of the fluidity one wants in the creative stage. The program necessarily carries a lot of baggage; much to the designers' credit, that baggage is generally well hidden from view. Coming face to face with quirks like the absence of page numbers, or the heavy-handed requirement to use only inch-type measurements, rather forcibly reminds you that the baggage is nonetheless there; it extracts its small, but real, penalty during the creative writing phase.

If this sounds like a lot of grousing, it's not. It's more that *Word* does so much so well that the few problems it does have stand out. *Word* is setting new standards for power, versatility, and ease of use, and it's to be expected that any new program of this caliber will have a few annoying characteristics. Relative to the vast number of features that *Word* implements, the number that aren't done quite right are relatively few. Just as important, Microsoft appears to be open to the desires of the market; if the majority of users ask for a change in a particular feature, you can be sure the company will comply.

On the other hand, the number of ways in which *Word* can ease the writing process is truly awe-inspiring; this review can't hope to cover them all adequately.

To start with, there's auto-reform. You have to use this feature to appreciate it fully. It seems so natural, you hardly notice anything unusual is happening. Until, that is, you go back to a word processor that requires a *reform* command to clean up the mess after you've inserted text; then you'll realize just how nice auto-reform is. And *Word* does the reform operation exceedingly well.

Another treat is the glossary. If you have words, phrases, sentences, paragraphs—even whole files—that you use often, you can store them in a glossary keyed to any abbreviations you wish; to insert one of these items in your text, simply type the appropriate abbreviation and hit F3. It's quite easy to add strings to the glossary and even easier to recall them (but do remember to save the glossary when you're done with your writing session). The first time you use the glossary, you'll get a charge out of seeing your abbreviation metamorphose into a whole sentence (or whatever); the second time you'll wonder how you ever did without it.

Multiple windows are another feature that, depending upon your job and work style, could alone be worth the price of a new word processor. *Word* allows you to open as many as eight independent windows (your choice of size) at one time; each window can either contain a separate file or look into a file that's open in any of the other windows. All windows are equal—each has its own scroll and select bars as well as optional style and ruler bars.

Cut and paste between windows is as easy (or easier) than cut and paste within a window: Simply change active windows after you cut and before you paste. Your own imagination can probably supply many uses for multiple windows; note taking and document merging come to mind. If you're doing a lot of cutting and pasting within a single document, opening two (or more) windows within the same document can speed things up immensely by letting

you view the source and the destination simultaneously.

Although new windows can be opened almost instantaneously—put the mouse cursor over the top or left border and click a button—there are a couple of problems with the way windows are handled. In particular, when a second window is opened, *Word* automatically loads it with the document open in the first. That's fine if you want two windows into the same document, but if you want an empty window—for note taking, for example—you must first clear the second window. You can quickly knock off the series of commands to do that, but you're not going to want to. Right now, hitting the left button while on the window border opens a window containing a copy of the current document; the right button could be used to open a blank window. And while we're on the wish list, how about a command-level option that forces the margins on newly opened windows to just fit within the display area?

Having read this much, you'd think by now we'd have covered at least all the major new features of *Word*. You'd be wrong. Consider, for example, style sheets.

Remember how easy it is to, say, boldface a word (or sentence, line, paragraph, or whole document)? Just select your text block, then hit alt-B. Well, style sheets let you define your own alt-Bs.

With style sheets you can define paragraph formats—margins, indents, type fonts, character attributes, and so on—and then apply those formats to any paragraph (or paragraphs) you choose. Simply select the text, then type any of the alt-code abbreviations you've defined in the current style sheet. You can apply formats from style sheets to characters, words, paragraphs, or whole divisions as easily as hitting two keys.

If you open a document without a specific style sheet attached, *Word* automatically attaches a sheet known as Normal.sty. Don't like *Word*'s default margins? Just go in and set your own in Normal.sty. If you write many different types of documents—rough drafts, final drafts, letters, software manuals—you can create different style sheets for each. You can even write an article using Draft.sty, attach Article.sty after the article is complete, and boom—your text will obediently reformat itself according to the definitions in Article.sty.

Word's manifold abilities to format the final document just so, combined with capabilities that let you create a driver routine customized to the peculiarities of your own printout device, mean that *Word* is well suited to drive sophisticated output devices such as laser printers and simple phototypesetters. (Don't worry; Microsoft supplies a set of drivers for all of the standard popular printers.)

A plethora of smaller features combine to

make *Word* even better. Those features range from a select bar that lets you instantaneously select lines, paragraphs, or the whole document, to display options that let you see end-of-paragraph and end-of-line markers, to a (generally logical) keyboard layout that uses the destructive backspace key to enter a destructive backspace, to the capability to accept any eight-bit character pattern via the alt-key number pad, to a formatting option that can automatically reformat your text into a specified number of columns.

An expert mode that uses extended multiple-keystroke patterns for quicker execution of special functions can be learned as needed, and in the meantime, almost any operation can be done in a number of ways—at least two, as a matter of fact, since all of the features can be tapped with or without the mouse.

One aspect of *Word* is bound to annoy experienced users: The command menu is always displayed, thus shrinking the display by three rows. Two more rows are taken up by the top and bottom window borders, so at times you don't have as much room for text as you'd like. A logical improvement would be an option to turn the main menu into a pop-up, a la *WordStar*'s search menu.

Changing word processors is a little like leaving your spouse to marry your lover: exciting, traumatic, fraught with peril and potential misunderstandings. Your new partner might be sexier, but if that's the only reason you switched, you'll be sorry when the honeymoon's over.

Word's value is much more than skin deep. True, it's got a lot of sexy features and it's friendly enough that you may get seduced in a hurry. But if you spend a lot of time with *Word*, you're likely to find that the infatuation wears off real fast. You may realize you're uncomfortable with this unique word processor, and the idea of spending every day with it may no longer look quite so appealing.

That's the time to put a little bit more into the relationship. As you get beneath that glossy user-friendly surface, you'll discover an exceptionally hard-working program, one that really can make your job go faster and with less hassle. Contrary to its appearance, *Word* is complex; it's bound to take longer to master *Word* than it takes to master its less powerful competitors. But you will master it, and when that happens you'll probably decide there's nothing that could get you back to your old word processor.

Microsoft expects to release *Word* in November, at a price of $475 with a mouse, or $375 without. *Word* requires a 128K machine with at least one disk drive (two are preferred). The word processor is supplied with a program that converts *WordStar* files to *Word* files; a *Word* option lets the program produce standard ASCII files when desired. ▲

WHAT'S ON YOUR PC MENU?

· BY DIAN GIRARD ·

One of the most effective ways of creating user-friendly programs is with menus. A menu is basically a display screen with numbered or lettered choices on it. A polite message at the bottom says something like "Please make your selection," and the system waits for the user to type in his choice—1, 2, or 3 or maybe A, B, or C. It's a nice way to lead a user through steps, and at the same time keep him from doing anything that would muck up the system too badly.

Although you may be comfortable with your pc, why not build a menu driver for it too? A simple menu can be used to keep the kids from meddling with DOS, and can be set up to save you from redundant keystrokes.

The key to using a menu is the Autoexec.bat file. If this batch file exists, the system always goes to it first for instructions, which means that you have complete control over what your system does after it boots. We've set up a system to display a menu with five choices. These choices allow you to check important monthly dates, see a random "thought for the day," run another Basic program, get into Basic, or exit to DOS. The first four choices automatically return you to the menu when the task is complete.

BATCH FILES

To set up a menu series like this, you need to create three small Basic programs and three batch files. One of the batch files, Runit.bat, is built within the driver program, which is written in Basic. The examples shown can be used as shown, but they're intended for an eighty-character display. If your monitor only displays forty characters, be sure to move all of the *print* text in the Basic programs to the left.

The important thing to remember in using batch files is that any program executed out of a batch file returns to that file. Figure 1 shows the three batch files. The first one is the four-line Autoexec.bat file. The first line, *Echo off*, suppresses the system display so that the user doesn't see the batch files being executed. (This is a DOS 2.0 command. If you are running DOS 1.1, omit this command.) The next two lines call for the date and time, as in a normal system boot. (One of the interesting features of DOS is that it will not prompt for the date and time if there is an Autoexec file unless the instructions are in the file.) The last line in the file causes the system to run a second batch file, called Setup.

Setup.bat calls BasicA and runs the program called *Menu. Menu.bas* (figure 2) is the main driver. It displays the menu choices, runs the calendar and random message programs, and creates the Runit file, if needed. Lines 20 through 160 clear the screen, display the menu, and ask for the user's selection. Lines 170 through 200 process the first four choices. Lines 205 through 230 handle the return to DOS. Since *Menu* will return to the batch file Setup after completion, and batch file Setup would return to Autoexec, the only way out of the loop is to create an intermediate batch file that just prints a message, after which *Menu* closes the file and exits BasicA by calling the System.

Since only choices 1 through 4 are intercepted with *Goto* statements, any other input will fall into the DOS exit code, creating an automatic error trap for numbers that are out of

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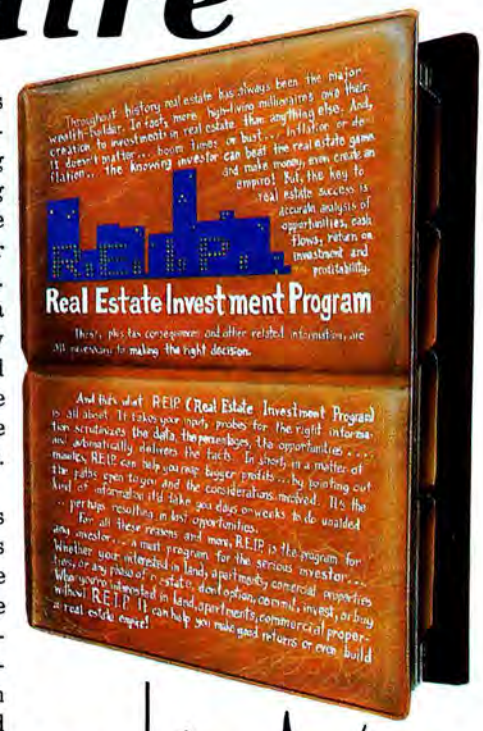

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range. If you would rather give users a second chance, instead of bouncing them out of the program, put in a couple of lines that check for input >5 or <1, Print an error message, and loop back to the *Input* statement.

Lines 250 and 270 of *Menu* are used to call two additional programs. Both of these programs (figures 3 and 4) end with the instruction *Run "Menu.bas"*, which causes the menu to reappear when the program has finished.

```
type autoexec.bat

ECHO OFF
date
time
SETUP

A>type setup.bat

BASICA MENU
RUNIT

A>type runit.bat

ECHO Now exiting to DOS. Good-bye from your friendly IBM BASIC!
```

Figure 1. Batch Files

```
10 REM this is a sample menu screen program
20 CLS
30 GOSUB 420 ' CENTER THE MENU SCREEN
40 PRINT "     ****************************************     "
50 PRINT "     *                                      *     "
60 PRINT "     *          TODAY'S IBM PC MENU         *     "
70 PRINT "     *                                      *     "
80 PRINT "     *       1 = Display monthly reminders  *     "
90 PRINT "     *       2 = Show the Thought for Today *     "
100 PRINT "    *       3 = Run a program              *     "
110 PRINT "    *       4 = Run BASIC                  *     "
120 PRINT "    *       5 = Exit to DOS                *     "
130 PRINT "    *                                      *     "
140 PRINT "    ****************************************     "
150 PRINT
160 INPUT "    ********Please make your selection: ",MENU
170 IF MENU = 1 THEN GOTO 240
180 IF MENU = 2 THEN GOTO 260
190 IF MENU = 3 THEN GOTO 280
200 IF MENU = 4 THEN GOTO 480 ' END OF PROGRAM
205 OPEN "RUNIT.BAT" FOR OUTPUT AS #1
208 PRINT
210 PRINT #1, "ECHO Now exiting to DOS. Good-bye from your friendly IBM BASIC!"
220 CLOSE
230 SYSTEM
240 REM ***** THIS SECTION INVOKES THE CALENDAR *****
250 RUN "CALENDAR.BAS"
260 REM ***** THIS SECTION INVOKES THE THOUGHT FOR TODAY *****
270 RUN "THOUGHT.BAS"
280 REM ***** THIS SECTION ASKS FOR A PROGRAM TO BE RUN ******
290 CLS
300 GOSUB 420 ' CENTER THE QUESTIONS
310 INPUT " Which BASIC program to you want to load? ",PROG$
320 PRINT
330 INPUT " Which disk drive (A: or B:) is that program on? ",DRIVE$
340 COLON$ = ":"
350 SUFFIX$ = ".BAS"
370 RUNPRO$ = "BASICA " + DRIVE$ + PROG$ + SUFFIX$
400 OPEN "runit.bat" FOR OUTPUT AS #1
405 PRINT #1, RUNPRO$
406 PRINT #1, "SETUP"
407 CLOSE #1
408 SYSTEM
420 REM ***** VERTICAL CENTERING CODE *****
430 FOR I = 1 to 10
440       PRINT
450 NEXT I
460 RETURN
470 REM ***** PROGRAM EXITS TO BASIC, BUT NOT TO DOS *****
480 END
```

Figure 2. Menu.bas

MENU DRIVER

In lines 310 through 408 the *Menu* driver asks for the name of a Basic program, concatenates the input with the drive identifier and the .bas suffix, and writes the information into the Runit batch file. Since this file is created dynamically, each time that section of *Menu* is run it can be used both to run a program or to print an exit message, depending on the user's choice.

Any program called this way, through *Menu*, has to end with a *System* statement to redisplay the menu. The *System* statement returns control to the Autoexec file, which restarts the loop. If there is no *System* statement the program ends, leaving the user in Basic.

Figure 3 shows a simple memorandum program, *Calendar .bas*. This program reads the input month number and then goes to a hard-coded display. The layout is simple and straightforward, so it's easy to make changes as time goes by. Notice the *Run "Menu.bas"* statement at line 1000 that returns control to the menu program.

Thought.bas, shown in figure 4, creates a table called B$ that has twenty-one quotations as entries. Lines 280 through 300 select one of the entries at random, and the line is printed at line 370. Since there are only twenty-one entries, each one will be seen fairly often. A larger table—say, one with 300 entries—would give a better selection. Notice that there is a *Run "Menu .bas"* statement at line 390, to return control to the menu program.

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```
10 REM **** this program says hello, and lists chores for
20 REM **** the month.
25 CLS
27 FOR I = 1 TO 10 ' CENTER TEXT
28       PRINT
29 NEXT I
30 PRINT "Hello there! Here's a list of reminders for"
50 REM **** fetch the current month
60 MS = LEFT$(DATE$,2)
70 IF MS = "12" THEN GOTO 870
80 IF MS = "11" THEN GOTO 800
90 IF MS = "10" THEN GOTO 740
100 IF MS = "09" THEN GOTO 680
110 IF MS = "08" THEN GOTO 610
120 IF MS = "07" THEN GOTO 550
130 IF MS = "06" THEN GOTO 490
140 IF MS = "05" THEN GOTO 410
150 IF MS = "04" THEN GOTO 350
160 IF MS = "03" THEN GOTO 280
170 IF MS = "02" THEN GOTO 220
180 PRINT "JANUARY:   1 - House payment is due."
190 PRINT "               15 - Aunt Suzy's birthday."
200 PRINT
210 GOTO 930
220 PRINT "FEBRUARY:  1 - House payment is due."
230 PRINT "               16 - Charles's birthday."
240 PRINT "               24 - Make plane reservations."
250 PRINT "               28 - Call roofers for estimate."
260 PRINT
270 GOTO 930
280 PRINT "MARCH:  1 - House payment is due."
290 PRINT "            3 - Our anniversary."
300 PRINT "            4 - Leave on vacation."
310 PRINT "           15 - Toby's party."
320 PRINT "           30 - Pay insurance premium."
330 PRINT
340 GOTO 930
350 PRINT "APRIL:  1 - House payment is due."
360 PRINT "          15 - Call Angela about the lobster."
370 PRINT "          24 - Mama's birthday."
380 PRINT "          30 - Call tree trimmers."
390 PRINT
400 GOTO 930
410 PRINT "MAY:  1 - House payment is due."
420 PRINT "          8 - Mother's Day."
425 PRINT "         10 - What time does the new comet whiz by?"
430 PRINT "         15 - Pick up Gwen at 8PM"
450 PRINT "         30 - Call Sandy about the buffet."
470 PRINT
480 GOTO 930
490 PRINT "JUNE:  1 - House payment is due."
500 PRINT "          15 - Pick up the disk drives."
510 PRINT "          19 - Father's Day."
520 PRINT "          30 - Pick up resume from Bowen."
530 PRINT
540 GOTO 930
550 PRINT "JULY:  1 - House payment is due."
560 PRINT "           4 - Westercon."
570 PRINT "          15 - Pick up Joe & Nancy at airport."
580 PRINT "          30 - Lunch with Mr. Carstairs."
590 PRINT
600 GOTO 930
610 PRINT "AUGUST:  1 - House payment is due."
620 PRINT "           15 - Send resume to Conklin & Co."
630 PRINT "           29 - Your birthday. You made it through another year."
640 PRINT "           30 - Labor Day Weekend - S. F. Convention"
660 PRINT
670 GOTO 930
680 PRINT "SEPTEMBER:  1 - House payment is due."
710 PRINT "               For a fun-filled weekend, clean out the icebox."
720 PRINT
730 GOTO 930
740 PRINT "OCTOBER:  1 - House payment is due."
750 PRINT "           15 - Orchid show - Anaheim."
760 PRINT "           30 - Miniatures show - Buena Park."
770 PRINT "           Don't forget Halloween treats for the little gremlins."
780 PRINT
790 GOTO 930
800 PRINT "NOVEMBER:  1 - House payment is due."
810 PRINT "           15 - Lunch with Angela."
820 PRINT "           24 - Thanksgiving, and Daddy's birthday."
830 PRINT "           30 - Call Aunt Suzy about the wok."
850 PRINT
860 GOTO 930
870 PRINT "DECEMBER:  1 - Last house payment!"
880 PRINT "           15 - Lunch with Dick Carstairs."
890 PRINT "           Xmas presents have got to be mailed this week."
900 PRINT "           **** COURAGE - Xmas only comes once a year **** "
920 PRINT
930 PRINT
940 PRINT "      Hit RETURN to go back to the menu."
950 INPUT A$
1000 RUN "menu.bas",R
```

Figure 3. Calendar.bas

tem. Adding and deleting choices is easy, and changing the text only takes a moment or two. By deleting the "return to DOS" choice, you can limit casual users to the information you want them to see and use. One helpful addition would be a second menu screen for choice 3 listing only the programs you want run and trapping all other entries as errors. Menus are flexible, easy to use, and make your pc that much more accessible. ▲

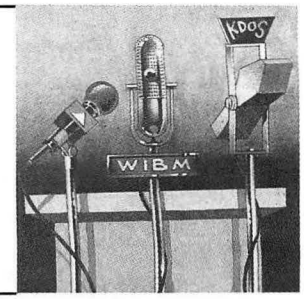
```
10 REM **** this is the Thought for Today program
20 DIM B$ (20)
30 FOR I = 0 TO 20
40       READ B$(I)
50 NEXT I
60 DATA "The handwriting on the wall may be a forgery."
70 DATA "Public office is the last refuge of the incompetent."
80 DATA "Give a child enough rope and he will trip you up."
90 DATA "Being bored is an insult to oneself."
100 DATA "The hen is an egg's way of producing another egg."
110 DATA "Everyone is ignorant, only on different subjects."
120 DATA "There is no failure except in no longer trying."
130 DATA "Love your enemy -- it will drive him nuts."
140 DATA "The wise make proverbs and fools repeat them."
150 DATA "Emotion has taught man to reason."
160 DATA "Science is the refusal to believe on the basis of hope."
170 DATA "Science is a history of superseded theories."
180 DATA "It is much more secure to be feared than to be loved."
190 DATA "If you aren't going all the way, why go at all?"
200 DATA "One man's remorse is another man's reminiscence."
210 DATA "Lord give me chastity -- but not yet."
220 DATA "Marriage has many pains but celibacy has no pleasures."
230 DATA "You can be sincere and still be stupid."
240 DATA "Always be sincere, even when you don't mean it."
250 DATA "A good catchword can obscure analysis for fifty years."
260 DATA "Hypothetical questions get hypothetical answers."
270 REM *** OKAY, WE'VE FILLED THE TABLE
280 RANDOMIZE (VAL(MID$(TIME$,7)))
290 N=20*RND
300 R =   INT(N)
310 CLS
320 FOR I = 1 TO 10 ' CENTER THE TEXT
330       PRINT
340 NEXT I
350 PRINT "The thought for today is:
360 PRINT
370 PRINT B$(R)
380 PRINT
390 RUN "MENU.BAS",R
400 END
```

Figure 4. Thought.bas

```
*****************************************
*                                       *
*          TODAY'S IBM PC MENU          *
*        1 = Display monthly reminders  *
*        2 = Show the Thought for Today *
*        3 = Run a program              *
*        4 = Run BASIC                  *
*        5 = Exit to DOS                *
*                                       *
*****************************************

Please make your selection: 5

Now exiting to DOS. Good-bye from your friendly IBM BASIC!

A>
```

Figure 5. Menu Display

marketalk news



Unless otherwise indicated, software listed runs in DOS on machines with either display adapter and requires 64K and at least one disk drive.

Δ **Correction:** The address was missing from this item in the August issue, so here it is again. From **Quest Research** (303 Williams Avenue, Huntsville, AL 35801; 800-533-9405): *Edlin Recovery Utility* permits you to recover a file lost during an Edlin session. $35. Δ *Diskpak* is a collection of five utilities, inluding an ASCII examine routine, a hex dump, and byte modifier. $60. Δ *Bigbuf* is a keyboard extension utility that allows you to expand your keyboard buffer. $45.

Δ The *Harvard Project Manager* has been unveiled by **Harvard Software** (Software Park, Harvard, MA 01451; 617-456-3400). The application package is a system for managers and professionals that does job planning and managing of projects of all types and sizes. A "road map" of the project is drawn on the screen, and a bar chart can be displayed that shows when each task begins and ends. $400.

Δ A keyboard mouse for the pc that includes an interface unit is available from **Product Associates** (465 Convention Way, Redwood City, CA 94063; 415-364-3121). Customizable cursor control codes are sent automatically, and three programmable switches are included on the unit. Five additional key switches can be added. No software required. $395. Game control adapter mouse: $150.

Δ DOS 2.0 compatibility has been announced by **Tall Tree Systems** (1036 Los Altos Avenue, Los Altos, CA 94022; 415-941-8748) for their *J-Format-2* utility package and their *Jetdrive* electronic disk drive. Δ The *MBP Cobol Compiler* is DOS 2.0-compatible. It's manufactured by **MBP Software and Systems Technology** (7700 Edgewater Drive, Suite 360, Oakland, CA 94621; 415-632-1555). Δ Also now running in 2.0 are the *EasyFamily* and *EasyBusiness Systems* lines of productivity and business management software from **Information Unlimited Software** (2401 Marinship Way, Sausalito, CA 94965; 415-331-6700).

Δ Five household programs in the *PC Wizards* series from **Systech** (5410 Baylor Drive, Bartlesville, OK 74005; 918-333-9693): *Math Tutor* provides arithmetic drills at different skill levels, plus four games. $39. Δ *EZ Converter* solves any common conversion problem (English, metric, and so on). $29. Δ *Mail Master* tracks and prints name lists, phone lists, and mailing lists. Holds five hundred names per disk. $59. Δ *Record Keeper* categorizes and tracks personal records. $59. Δ *Money Planner* makes financial planning easy with budgeting, net worth reporting, interest calculations, and more. $59.

Δ A Z-80 coprocessor board that enables the pc to execute CP/M 2.2 or CP/M 3.0 programs has been released by **California Computer Systems** (250 Caribbean Drive, Sunnyvale, CA 94086; 408-734-5811). The Z-Plus board makes available twenty-five hundred applications not covered by CP/M-86. The memory may be used by the 8088 processor when the card is not in use. Supports 64 to 192K. Also supports the Osborne floppy disk. 64K: $875. 192K: $995.

Δ Written by CPAs with extensive real estate experience, *Real Estate Tools I* from **Ansonn Software** (2801 North Surrey Drive, Carrollton, TX 75006; 214-446-4340) consists of more than forty-five menu-driven analyses for mortgages, leases (level and uneven payment), construction loans, and grouped and variable cash flows. Analyses include internal rate of return, net present value, price to pay, points, yield, and more. Requires two double-sided drives and 128K. $299.

Δ A Command Control mouse has been announced by **Wico** (6400 Gross Point Road, Niles, IL 60648; 312-647-7500), manufacturers of game-control hardware. The mouse can function as a word processing editor, spreadsheet analyst, or alternate input device and features multiple function buttons. Originally developed in the sixties for CAD-CAM use, it can be used with Wico-designed interface controller cards. $99.95. Controller card: $129.95.

Δ *Office Filer* is a fill-in-the-blanks electronic filing system with password protection from **Digital Marketing** (2670 Cherry Lane, Walnut Creek, CA 94596;(415-938-2880). The program supports arithmetic and logical expressions, allowing the user to calculate running totals for numeric fields or arithmetic constants. Function keys provide a one-stroke command; reports can also be generated. Requires 128K. $395.

Δ More than a mailing list management system, *BusiPost* manages your list and reminds you to follow up on promises, appointments, and telephone calls. The program can sort or select on any field in alpha-

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betic or numeric order and includes a simple word processor. $295.

Δ The tenth annual Information Management Exposition and Conference, *Info 83*, will feature fourteen groups of specialized business application sessions when it convenes at the New York Coliseum October 10-13. Sponsored by **Show Management** (708 Third Avenue, New York, NY 10017; 212-370-1100). Topics of discussion will include personal business computers, strategies for information management, and decision support systems. Call for ticket information.

Δ **Digital Research** (160 Central Avenue, Pacific Grove, CA 93950; 408-649-3896) has announced *DR Graph*, a graphing application package that runs under Concurrent CP/M. An interactive graphics and editing tool for slide presentations, trend charts, and financial analysis reports, the package interfaces with a variety of plotters, printers, and CRTs. Can also create graphs from *VisiCalc* and *SuperCalc*. $295.

Δ The *Aura 5* system of integrated office software incorporates a database management system with a report generator, a spreadsheet, graphics, a word processor, and a three-mode communications package. From **Softrend** (87 Indian Rock Road, Windham, NH 03087; 603-898-1777). The modules are menu-driven with user-definable function keys. First release—dubbed *Aura 3*—includes the database, word processor, and spreadsheet. For MS-DOS or Xenix. $395. Second release—*Aura 4*—includes graphics. $495.

Δ Prices slashed! **Sheppard Software** (4750 Clough Creek Road, Redding, CA 96002; 916-222-1553) has announced a price reduction on *MicroPERT 0*, the company's graphics-oriented project management package. Several new features have been added: The package now supports most eighty-by-twenty-five monitors, both the Epson and IBM printers, and a number of hard disks. Can also switch back and forth from mono to color at will. $300.

Δ A program for printing characters up to seven inches high, *Big Print*, from **ATC Software** (Route 2, Box 448, Estill Springs, TN 37330; 205-837-4718), works on standard printers. $50.

Δ Games from **Fast-N-Fun Video** (3507 North Central, Phoenix, AZ 85012; 602-831-9363): *Ultralight Command* is a high-speed arcade game that has you defending your airspace from waves of animated attack helicopters, alien pods, and saucers. Requires color/graphics adapter. $39.95. Δ *Schultz's Treasure* is a 3-D adventure search for the famous Lost Dutchman's gold mine with over ten thousand mine layouts. No text inputs required. Requires color/graphics adapter. $39.95. Δ *Super Novatron* is a 3-D maze game. The computer builds walls as you navigate. Can be played by three people simultaneously in competition. Requires color/graphics adapter. $39.95. Δ *Novatron Trilogy* is a three-game monochrome package that includes a maze game, a gridwalker game, and a construction game. $29.95.

Δ An easy-to-use filing system and report writing program called *Fast Facts* has been announced by **Innovative Software** (9300 West 110th Street, Overland Park, KS 66210; 913-383-1089). Handles personnel records, mailing lists, or recipes. Retrieval of records determined by user; items can be called up in combinations. Writes to *VisiCalc*, *1-2-3*, and *MultiPlan* in a DIF format and interfaces with *WordStar*. $195.

Δ A set of custom-made, smoke-colored plastic dust covers for the keyboard and disk drives is available from **CompuCable** (1440 South State College Boulevard, Anaheim, CA 92806; 714-635-7330). $19.95.

Δ Designed for home use, *Dollars & Sense* is a personal finance management package from **Monogram** (8295 South La Cienega Boulevard, Inglewood, CA 90301; 213-215-0529). Displays of financial information and easy-to-read color charts and graphs help users without accounting experience keep tabs on expenses, balance checkbooks, and plan and follow budgets. Requires color/graphics adapter. $165.

Δ *MultiMate* software turns the pc into a Wang-like dedicated word processing machine for document creation and modification. From **SoftWord Systems** (52 Oakland Avenue North, East Hartford, CT 06108; 203-282-0131). The program features more than eighty editing functions, immediate screen formatting, merge functions, and file con-

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Δ A security shelf system called Omni-Lock provides "lock-down" of keyboards, dual disk drives, and monitors through a single lock of the shelf spindle. From **Micro-Metrics** (908 South Claremont Street, San Mateo, CA 94401; 415-342-8466). The shelves individually swivel three hundred sixty degrees to allow complete access to internal cards and components. Full ventilation provided. $339 to $419.

Δ *Smart Cache*, from **EKC** (6100 Shenandoah Avenue, Los Angeles, CA 90056; 213-641-3390), is an intelligent electronic disk that provides caches for two 360K drives and a 360K RAM disk. Rewrites files automatically, writes unnoticeably, performs anticipatory full-track reads, holds files in cache, and more. A common area of memory is shared by both caches and the RAM disk. Requires 192K. $59.95.

Δ **Pacesetter Software** (Box 5270, Princeton, NJ 08540; 609-737-8351) has introduced *Organization Map*, a software package in two parts. The *Human Resources Support System* provides a complete description of an organization's structure, spans of control, and staffing levels. *Organization Analysis and Productivity Improvement Support System* presents a detailed view of work activities and their costs. $5,500. Demo disk: $35.

Δ *Realfast 1* is a Microsoft Fortran accelerator that links the Intel 8087 chip, and processes numerical data two to five times faster. From **Geostat Systems International** (Box 1193, Golden, CO 80402; 303-277-0070). The package routes all 32-bit integer and 32/64-bit floating point arithmetic to the math chip for addition, subtraction, multiplication, division, trigonometry, exponentiation, log, and module operations. $159.50.

Δ *Form Writer* version 1.1 is a combination mail merge, data management, and word processing package from **Business Development International** (Box 5, Station A, Winnipeg, Manitoba, Canada R3K 1Z9; 204-837-8509) that's now compatible with both letter-quality or matrix printers. With many definable options, the program can be copied to hard disk for shared access by other machines. $275.

Δ A set of tab dividers for the Basic and DOS manuals is available from **Siechert & Wood** (133 West Colorado Boulevard, Pasadena, CA 91105; 213-449-1276). The sixteen dividers are Mylar-reinforced and covered with information summarizing the section the tab references. More information is on reverse of tab. DOS 1.0/1.1 and 2.0 versions available. $9.95.

Δ *The Directory of Mailing List Programs for the IBM Personal Computer* has just been released by **System 33** (Box 25395, Los Angeles, CA 90025; 213-826-5840). Thirty-six programs are reviewed and two charts compare more than ninety criteria under categories of basic information, system environment, input, processing, and output. $6.50.

Δ **SolveWare** (Box 1246, Redondo Beach, CA 90278) has announced a familiarization and programming support package for the Intel 8087 coprocessor called *SevenWare*. The package includes three files: Test87 verifies installation and functioning; Intro87 is an interactive demonstration; and MacLib87 is a macro library that extends the IBM *Macro Assembler* to support the 8087 instruction set. $79.

Δ Written for members of the medical and health professions, *The Internist* performs differential diagnoses. From **N-Squared Computing** (5318 Forest Ridge Road, Silverton, OR 97381; 503-873-5906), the program is based on the Merck manual and allows the user to run differential diagnoses on any combination of more than 450 symptoms for 331 diseases. A disease reference module displays associated symptoms for display or printout. $65.

Δ *Keytools*, a utility from **Key-1 Computer Systems** (178 Spring Street, Newport, RI 02840; 401-849-4562), includes more than fifteen different programs designed to speed the production of programs written in Advanced Basic under PC-DOS 1.1. Features include a multifaceted screenmaker, a formatted data entry subroutine, and an on-line help facility builder. Disk tutorial included. Requires one double-sided disk drive. $40.

Δ The *1-2-3 Executive Personal Computing Workshop* is a two-day hands-on training course. The *MBA Executive Personal Computing Workshop* is a three-day course. The *Personal Computer Awareness Seminar* is a one-day understanding of microcomputers. All three events are presented by **National Training Systems** (1111 Broadway, Santa Monica, CA 90401; 213-394-7685) in contract situations with interested corporations. Call for information.

Δ A Basic program generator with full-screen access and the ability to manipulate up to sixteen different screen formats is available from **Key Solutions** (Box 2297, Santa Clara, CA 95055; 408-554-6125). *DataBurst* is a design tool for any Basic programmer; it creates screen formats and generates Basic programs for any application. All screen and keyboard I/O is handled through one assembly language subroutine. $225.

Δ The Key-by-Key Series is a series of books that enable the user to produce a general ledger accounting system or payroll system using *VisiCalc* or *SuperCalc*. *General Ledger and Accounting System for VisiCalc*: $19.95. Δ *Payroll for VisiCalc*: $19.95. Δ *General Ledger Accounting System for SuperCalc*. $19.95. Δ *Payroll for SuperCalc*. $19.95. Published by **Wadsworth Electronic Publishing** (8 Davis Drive, Belmont, CA 94002; 415-594-1900).

Δ Use the pc in place of HP2624, HP2648, and VT52-type display terminals with *VDTE 2* from **Inner Loop Software** (Box 45857, Los Angeles, CA 90045). The software includes a general-purpose file transfer system that requires no special programming on most host computers to transfer ASCII files. Both serial ports can be used, with seven pages of off-screen scrolling memory per port. With ten speeds up to 9,600 baud. $200.

Δ Designed to work with *1-2-3*, *Mind Tools* from **Expert Systems** (Box

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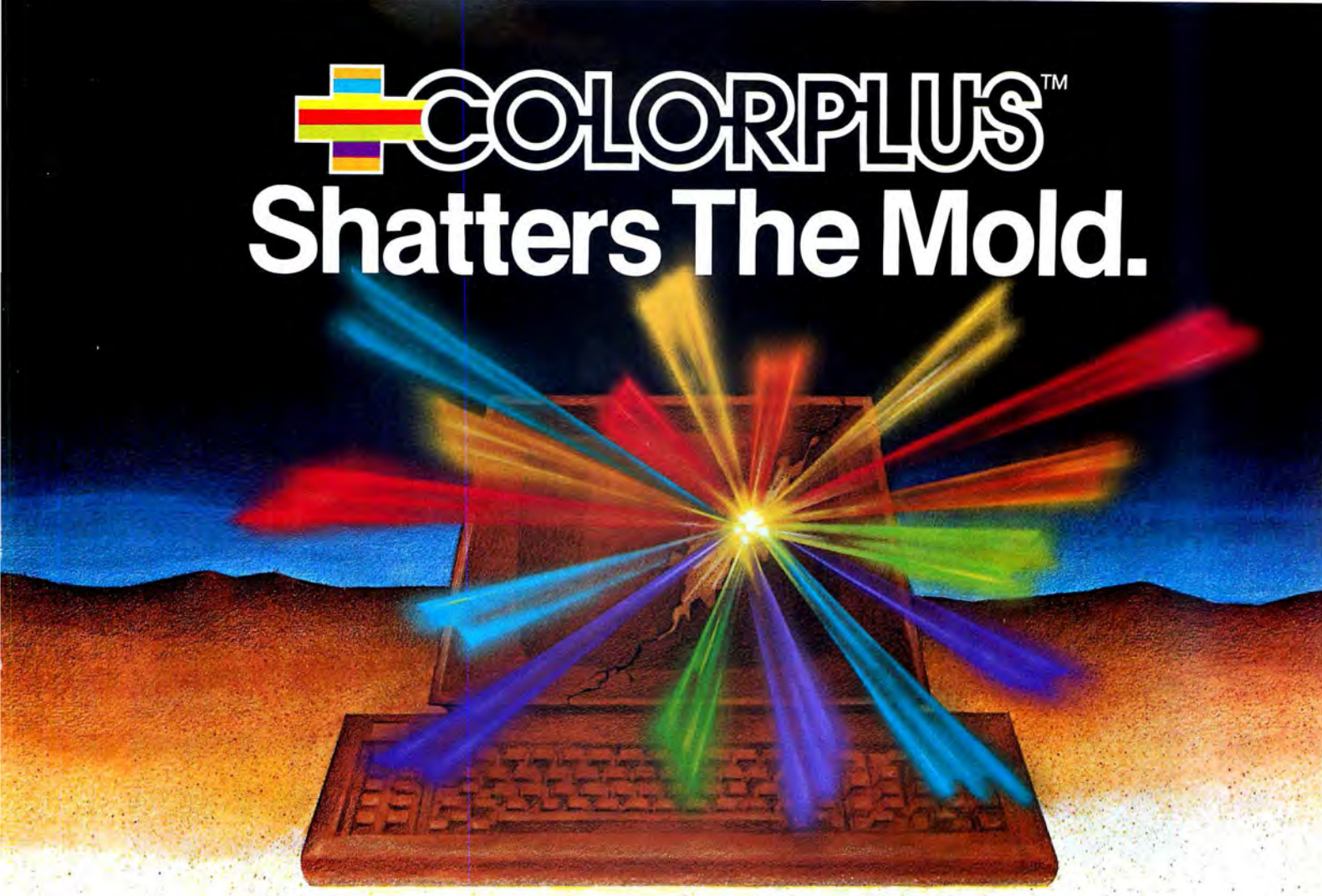

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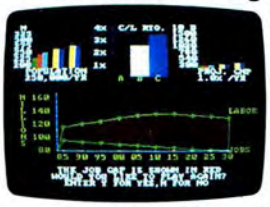

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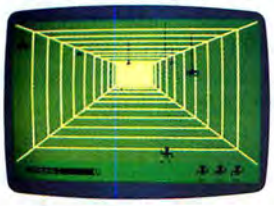

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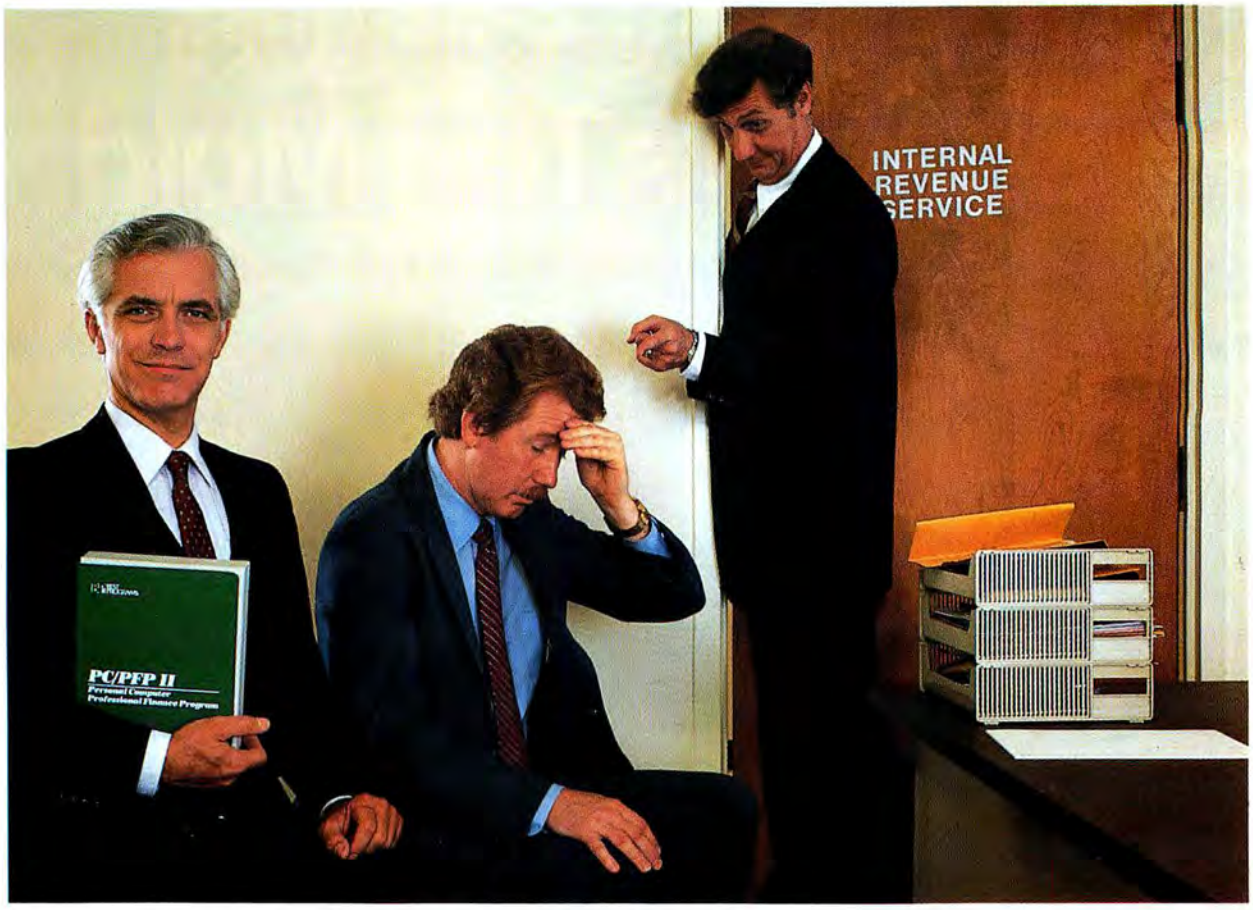

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9, Redmond, WA 98052; 206-883-8086) includes Financial Planning, a business and financial calculating package; Small Business Accounting, an accounting system for small business owners; Home Budget and Check Register, a personal finance budgeting system; Real Estate Analysis, which assesses the profitability of real estate investments; Property Management Analysis, which helps property owners keep track of units, maintenance, and finances; and Personal Finance II—Investment Analysis, which simplifies the analysis procedures used by stock, bond, and insurance investment professionals. From $69.

Δ **Visual Horizons** (180 Metro Park, Rochester, NY 14623; 716-424-5300) has introduced *Computer Slide Express*, a service that converts computerized charts, designs, graphs, and graphics to 35mm color slides, black-and-white or color prints, or transparencies. Information can be transmitted over phone lines, or mailed in the form of a floppy disk, for up to thirty-five slides. Material delivered through the mail. $6 per slide.

Δ *Snapshot* is a financial reporting package that produces financial accounting statements and graphic charts of business data. Designed for small business, the software creates income statements, balance sheets, cash-flow reports, and financial ratio analysis reports using a fixed spreadsheet format. From **Snapshot** (634A South Fifteenth Street, Arlington, VA 22202; 703-979-3595). Requires 96K. $150.

Δ *Balancing Act*, from **Micro Computer Applications** (127 Spruce Street, Lake Jackson, TX 77566; 409-297-8537), is a personal and small business accounting package that features advanced screen posting, editing, and reviewing with one-touch scrolling through entries. Eight separate accounts are managed per disk, allowing up to 3,400 entries with one drive and 4,900 with two. Requires eighty columns. $37.50.

Δ Created for the designer and artist as well as the businessman and student, *4-Point Graphics* creates business graph, charts, 2-D, and 3-D designs. From **International Microcomputer Software** (Box 2643, San Anselmo, CA 94960; 415-454-7101). The package draws shapes such as arcs, ellipses, parabolas, and polygons and combines them with text in a single report. 128K, color/graphics adapter, and color printer required. $225.

Δ A multifunction card from **Seattle Computer** (1114 Industry Drive, Seattle, WA 98188; 800-426-8936) called the *RAM+3* gives users a time-of-day clock/calendar with battery backup, a parallel printer port, and RS-232 serial port, and options for as much as 256K of additional RAM. Five memory options available. *Flash Disk* utility software included. From $210 to $620, depending on memory expansion installed.

Δ Explore the lighthearted side of science fiction with *Planetfall*, the interactive prose adventure from **Infocom** (55 Wheeler Street, Cambridge, MA 02138; 617-492-1031). The game challenges you to save a doomed and plague-stricken planet while trying to keep a straight face. Floyd, an impish robot, is your companion in the ten-hour adventure. Comes with Stellar Patrol ID card, space diary, and futuristic post cards that complement the story. $49.95.

Δ MicroTalk is an interface that allows the user to exchange data with either the PRIME Information Series or PRIMOS files. From **Software Management Systems** (84 Inverness Circle East, Englewood, CO 80112; 303-741-3179). The package contains a PRIME terminal emulator and upload and download functions. Prompt-driven; works via modem or locally. Amount of data transmitted limited only by disk size. $300.

Δ *CommTalk* is communication software that provides automated access to information retrieval services such as the Source and Dow Jones. From **Professional Software Associates** (5353 Wayzata Boulevard, Minneapolis, MN 55416; 612-541-0742). The system also functions as a smart terminal providing communication with host mainframes, service bureaus, and other micros. Electronic mail, network interface, and other expansion modules available. $89.95.

Δ A portable computer station on rollers, the Freedom III, holds the keyboard, system unit, monitor, and a printer. From **HSP Computer Furniture** (Box 5545, Birmingham, AL 35207; 205-251-0500). The unit incorporates a lockable roll-top and sliding keyboard shelf. Options include locking casters, disk drive shelf, and multiplug outlet. Comes in teak, oak, or walnut woodgrain with laminate finish. Freedom III, $8.50; disk drive shelf, $30; multiplug outlet, $40; locking casters, $15.

Δ A series of books aimed at pc applications from **John Wiley & Sons** (605 Third Avenue, New York, NY 10158; 212-850-6000): *PC DOS: Using the IBM PC Operating System* and *CP/M for the IBM*, by Ruth Ashley and Judi Fernandez. Both are complete, detailed introductions to the two operating systems. $14.95 each. Δ *IBM PC: Data File Programming*, by LeRoy Finkel and Jerald Brown. Explains how to in a clear, step-by-step format. $14.95. Δ *PC Graphics: Charts, Graphs, Games, and Art*, by Richard Conklin. Uses Basic to create everything from business charts to engineering data plots to arcade games. $15.95.

Δ Transfer files from the Radio Shack Model II, 4, 12, and 16 to the pc or XT with file transfer software from **Personal Computer Products** (1400 Coleman Avenue, Santa Clara, CA 95050; 408-988-0164). Included in the package is a communications program as well as an adapter that allows the two systems to connect. Any file can be transferred, whether it be ASCII, embedded control codes, or high-level language. $89.95.

Δ Version 4 of *DB Master* has been announced by **Stoneware** (50 Belvedere Street, San Rafael, CA 94901; 415-454-6500). New features include a QuickGuide manual, sample files, free backup, and revised upgrade policy. $350. Upgrade: $150.

Δ A version of *Context MBA* for the XT has been released by **Context Management Systems** (23864 Hawthorne Boulevard, Torrance, CA 90505; 213-378-8277). Faster performance and enlarged workspace are offered, as well as telecommunications capability. $695.

Δ Retail computer shop managers can use *Personal Computer Pricer,* menu-driven software from **Multisoft** (14025 Southwest Farmington Road, Beaverton, OR 97005; 503-626-4727), which keeps track of prices on the hardware and software they sell, as well as creating price quotes for customers. Package includes a complete copy of the *StretchCalc* spreadsheet program. Requires 128K, color/graphics adapter, and dot-matrix printer. $149.

Δ An inventory package from **CYMA** (2160 East Brown Road, Mesa, AZ 85203; 602-835-8880) includes complete inventory control, bill of materials, and sales and purchase order processing facilities. The CYMA system allows multiple locations, variable-length part numbers, automatic price markups and price calculations, and more. It also prints purchase orders, price lists, sales orders, invoices, and so on. $1,095.

Δ *Expense Track I* is a menu-driven program for home and small business use that features several expense files on the same disk, storage of up to 4,992 entries (on a double-sided disk), and auto-repeat to eliminate multiple entry. From **Sapana Micro Software** (1305 South Rouse, Pittsburg, KS 66762; 316-231-5023). Requires eighty columns and a printer. $49.95.

Δ Two file storage boxes have been introduced by **Stor Wares** (1849 East Sixty-fifth Street, Cleveland, OH 44103; 800-421-4637). One model holds seventy-five disks, the other holds one hundred fifty. Both are stackable and come in walnut woodgrain or black Leatherette finish. $9.95 and $14.95. Label kit: $2.95.

Δ **Software Labs** (1052 Lily Avenue, Sunnyvale, CA 94086; 408-241-9539) has announced a set of Fortran-callable library routines featuring color graphics, screen control, communications port control, and music generation. The *Fortran Utilities Package* provides many of the features found in IBM Basic, including draw routines. A graphics cursor, multiple pattern fill, and music-composing routines are additional features. Requires 128K and two disk drives. $119. Demo: $19.

Δ *Wall Street Plotter* is stock market plotting software from **Spring Dale Software** (1507 Evesham Road, Voorhees, NJ 08043; 609-795-1454) designed for the investor who makes trading decisions for particular stocks based on technical analysis of stock price and volume patterns. The investor can generate a multitude of stock charts such as price/volume, moving average, on-balance-volume, and point/figure. No database subscription required. $169.

Δ Transmission of files from any VM/CMS mainframe system is possible with *Please* from **VM Personal Computing** (60 East Forty-second Street, New York, NY 10165; 212-697-4747). The package allows uploading and downloading of any format data over normal asynchronous phone lines with full error detection and correction in both directions. *Personal Please,* supporting a single copy of *Relay*: $99. *Corporate Please,* designed for the business environment: $1,495.

Δ The DOS 2.0 version of the *Palantir* word processor is available from **Designer Software** (3400 Montrose Boulevard, Houston, TX 77006; 713-520-8221). New release also runs under DOS 1.1. $450.

Δ *Decision* is software designed to facilitate decision making by helping to organize, quantify, and sum subjective evaluations. From **Once Begun Computations** (Searsport, MA 04974; 207-338-1082). The package can compare up to twenty-one alternatives having up to eighteen weighted attributes. An overall value and an adjusted value for income or expense is developed for each alternative. Requires eighty columns and 96K for DOS 2.0. $20.

Δ A menu-driven interface linking the pc to the Pick operating system is available from Omnar (12517 Chandler Boulevard, North Hollywood, CA 91607; 213-985-3004). Uploading, downloading, 9,600 baud, and help function are featured in the package. Once data are accessed, the pc switches back into a computer and converts the data into specific formats such as *1-2-3* or *WordStar.* $1,895. ▲

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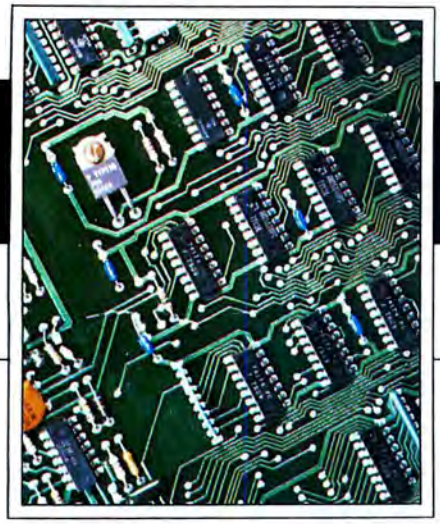


BOARDS AND BUSES

by Kevin Goldstein

The LNW Busboard

What is probably the most innovative, exciting, money-saving, and just plain useful pc expansion card—and to call it simply an expansion card is really selling this product short—has just been introduced by a company called LNW Computers. It's a product you're going to be hearing a lot more about, so read on.

Before we get to that though, two issues ago we promised some more information on Great Lakes's $1,000 hard disk. Because of the extent of interest shown in that product, and because of the effect an imminent change in Great Lakes's distribution policy could have on your purchase decision, this column is going to take a short detour to talk a little about the Great Lakes disk—even though, for reasons discussed below, the complete review will have to wait until a later issue.

First off, Great Lakes's offer is for real. The $1,000 gets you a ten-megabyte hard disk, case, power supply, cables, controller, and configuration software—the whole shooting match, ready to plug in and use. The hard disk is made by Shugart, Great Lakes is shipping, the whole unit is nicely packaged, and everything works pretty much as you'd expect.

With the exception of the fact that the disk occasionally needs to be jump-started.

That's right, jump-started. Turn it off, reach inside, give the flywheel a little push, turn it back on, and everything's fine. According to Great Lakes President Dick Brown, after about three hundred units were shipped, a rather unusual quirk started showing up in about 1 percent of the drives: they didn't always start spinning when the switch was turned on. To Great Lakes, the most exasperating aspect of the problem is that it doesn't show up in the company's preshipment test or burn-in procedures.

Since the defect has only surfaced in a few units that have already been shipped, it's quite likely that the fault can be ascribed to a poorly designed shipping carton. The company recently changed its shipping carton to one offering greater shock protection; that will probably take care of the problem.

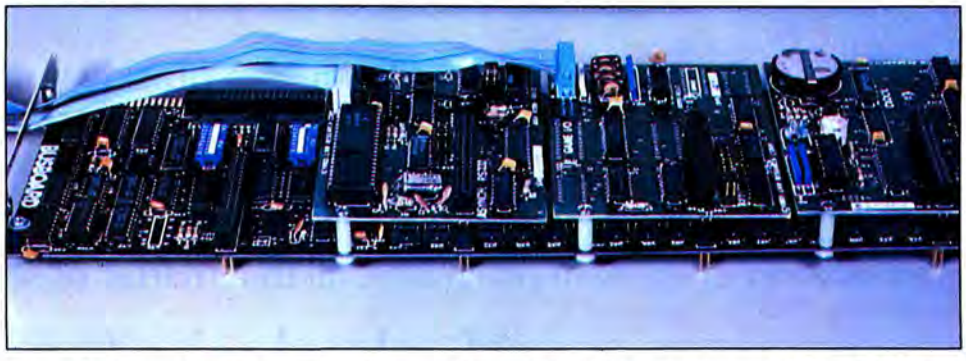
Great Lakes is exchanging *Softalk*'s drive for another one, so the complete review will have to wait until the next issue. According to Brown, any customer receiving a bad drive will get an immediate replacement.

There is one item that needs to be mentioned before the review, however, because of its timely nature. According to Brown, the $1,000 price is good only for disks ordered via mail order. The catch is that Great Lakes plans to shut down mail order distribution very shortly, opting instead for distribution only through dealers. With a planned retail price of $1,395, that's still a very good deal, although clearly not as sweet as the mail-order arrangement. The flip side, of course, is that you'll have dealer support; you shouldn't have to worry about getting a disk that needs jump-starting. When operating through dealers, the company will go under the name of Pegasus.

So you pays your money and you takes your choice. If your choice happens to be mail order, you'll have to act fast. For those of you who do decide to save the extra bucks and go the mail-order route, here are a few things about the drive that struck me.

First off, it works just fine. Having gotten used to a hard disk, I have no desire at all to live without one. On a negative note, the unit we got occasionally makes a nerve-racking squeal. The noise is caused by a pad that rides against the flywheel; the pad's purpose is to discharge static electricity. The noise is harmless, although occasionally maddening. In all fairness, however, it is also quite infrequent.

How would you like to be able to add up to 512K of memory, a communications port, a clock-calendar circuit, a game controller port, a modem, a speech synthesizer—even an entire coprocessor—all in only one expansion slot? A new expansion subsystem, the Busboard from LNW, will let you do just that. The beauty of LNW's system is that it lets you pick and choose from a lengthy and growing catalog of functions only those circuits you actually need—unlike other combination cards that force you to buy maybe three functions you don't want just to get the three functions you do want.



The basic concept underlying LNW's expansion system—and "system" is truly a more accurate term for it than card—is so obvious it's almost a surprise no one came out with it earlier. The heart of the system consists of a full-length master board, or Busboard, which occupies a single expansion slot in the pc chassis. Crammed onto the Busboard are sockets for 512K of RAM (the board comes standard with 64K installed), plus four female sockets on the front and four male jacks on the back. Small circuit boards, each containing a single function—a clock-calendar, for example—can plug directly into any of the four sockets on the front side or four jacks on the back side; the small single-function circuit boards are called

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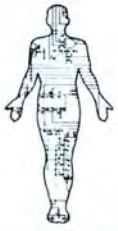

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modules. Most modules are single size, meaning each one is a fourth the size of a standard expansion board; some modules, such as coprocessors and disk controllers, are dual size.

Conceptually, you could view the Busboard as a sort of internal expansion chassis. The Busboard can directly hold up to four single-sized modules on the front, plus another four on the back, for a total of eight user-selected functions plus—512K of RAM. But even that's not the end of the expansion possibilities.

Duplicated on each module is a plug and socket identical to the one on the Busboard. Plugging a module into the front side of the board uses the male plug on the bottom of the module and leaves the female socket on the top of the module open; you can, if you wish, plug another module into the first. It's a little like stacking up paper cups. Theoretically you can keep adding modules until your horizontal tower of pc either runs out of room in the chassis, gets too tipsy for even a Saturday night, or draws more power than the pc's power supply can put out.

Because resources are finite, there are some other constraints to unbridled growth. If you mount the Busboard in the extreme left expansion slot (as you face the pc), you'll probably find that a module mounted on the back side of the Busboard at its frontmost location will interfere with the speaker. And if you place the Busboard adjacent to the disk controller card, the wide front edge connector on the controller card may hit a module mounted on the front side of the Busboard. (There's a simple way out of the latter problem: Use LNW's disk controller module, throw out IBM's oversized card, and gain a free slot in the bargain.) You'll have to experiment to find the best slot for the Busboard; the manual offers some good guides as to what slot might make the best home.

As of now, you can pick and choose from a catalog offering a fairly wide variety of functions:

- A clock/calendar module comes complete with battery backup and some rather extensive software. In addition to routines that automatically reset the pc's system time and date on power-up and display them on command (either from DOS or by way of your program), the clock software (called *Bustime*) features up to ten settable alarms. Both one-time and repeating alarms can be set. The combination of the clock/calendar module and *Bustime* provides the capabilities you need to run automatic batch operations.
- A single-sized asynchronous communications module can serve as a direct replacement for the IBM card. (Except for those systems requiring a current loop. Unless you have or plan to buy a Teletype, don't worry about that missing "feature.") The board allows for jumper-selectable interrupt priority level and configuration as either data communication equipment (DCE) or data terminal equipment (DTE). (If you don't know what that last sentence is talking about, keep your eye on future installments of Comm Lines, which will make it all perfectly clear. For now, it's enough to know that's a nice feature to have.)
- A single-size IBM-compatible parallel printer module can be configured as Lpt1 or Lpt2, or as a user-defined Lpt3, for those of you with lots of printing to do.
- An IBM-compatible game I/O control adapter module can be connected to any IBM-type joystick or paddle; four buttons and either two joysticks or four paddles can be hung off the module.
- A dual-size floppy disk controller module can support either 5-¼" floppy disks, eight-inch floppies, or combinations thereof. The controller is not only totally IBM compatible, LNW Vice President Ken Woog says it offers better performance than the IBM card. According to Woog, LNW's use of a phase-locked loop data separator also allows fairly reliable use of inexpensive disks in double-density mode. Since trying to double-density format single-density disks with IBM's controller turns up bad sectors in about half the cases, we'll be checking LNW's claim; if the claim is true, the LNW controller could save you money and bring additional peace of mind.

Not all modules mentioned in the intro are available yet: a 300-baud auto-dial modem is ready for production, for example, but is still awaiting FCC approval. The speech synthesizer is a little farther down the road.

Some other truly exciting boards are in various stages of planning or preproduction, including a controller for BSR-type remote control devices, a 1200-baud modem, a hard disk controller, an EPROM programmer, and a network controller—to name just a few.

Oh yes—and a pair of coprocessors. Eventually, you'll be able to plug in another 8088 or a Z-80 coprocessor and transform your pc into a two-processor system; the processors can be configured to run independently (that is, simultaneously) or in a master-slave mode. It's likely that OEMs—original equipment manufacturers, like Tandon, for example—will take a lively interest in the coprocessor boards.

And now for the big question: How well does the system work?

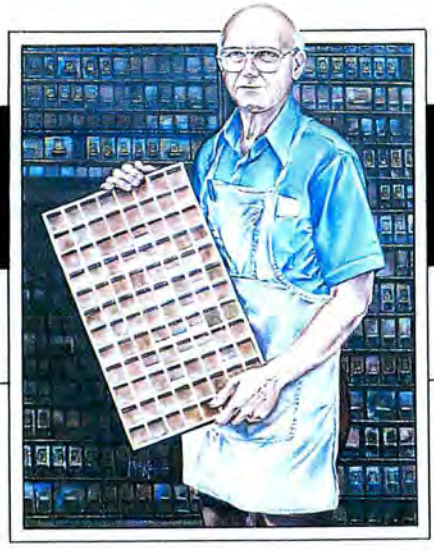
Like a champ. *Softalk*'s machine has a Busboard with 64K (for a total 320K of system memory), an async board, and the clock/calendar installed, and it works to perfection—no problems, no hassles, everything just does what it should.

Besides *Bustime*, the basic system comes with both print-spooling and electronic-disk software. Look for a report on these in a future issue.

One slightly sticky point is installation. The pages of tables dedicated to figuring out whether your proposed configuration will draw more power than the pc can put out are off-putting; this is the type of thing that a program should figure out for you. And what with all the modules you can install, you're going to have a real spaghetti of cables drooping off that card, all trying to exit through a single rear panel connector slot. The logistics required to keep the cables from tying themselves in knots can get pretty complex, so follow the instructions carefully. Even if you do, you can expect it's going to take a few trial runs to get your card inserted properly; once it's in, though, you'll surely consider the slot savings worth the effort. If you're really squeamish (and/or there will be a goodly number of modules installed on the Busboard), consider having your dealer do the installation for you. Installing the card with no modules or one module isn't too bad if you follow the directions carefully.

Incidentally, if you've never heard of LNW, rest easy: The company has been quite successful making boards and compatible computers for the TRS-80 market. Judging from their initial foray into the IBM market, they're about to repeat that success. ▲

Great Lakes Computer Peripherals, 2200 West Higgins Road, Suite 245, Hoffman Estates, IL 60195; (312) 884-7272. LNW Computers, 2620 Walnut, Tustin, CA 92680; (714) 544-5760.



The Printed Word

by John Dickinson

The Intelligent Printer, Part I

This may come as a surprise to you, but the printer attached to your IBM Personal Computer is intelligent. Its intelligence is there for a specific reason—to help you print flexibly, neatly, and quickly.

Printer intelligence is one of the most obscure and misunderstood concepts having to do with microcomputers. Yet, even the least expensive of today's breed of microcomputer printers has an impressive amount of it. That intelligence can be used to produce printed output with greater flexibility and quality than is possible using either of the printer's cousins—the typewriter or the computer terminal. Many models commonly used by pc owners are even capable of producing better quality output than printers used by expensive commercial word processing systems.

Of course your pc's intelligence and the software you use control the basic ability of your printer to produce output. When you command your pc to print something, a sequence of instructions begins. Each instruction results in the printing of a character or in some other kind of printer action, such as a line skip or carriage return.

Between the time the instruction leaves your pc and the time a character is printed or an action takes place, a surprising number of events take place. Each of these events requires one or more decisions and actions on the printer's part. Since the instruction to print a character comes from your pc, it is actually the cooperation between the intelligence of your pc and the intelligence of your printer that causes printing to occur. As we'll see, printing can be done as flexibly as you want — given the limits of your printer's capability.

This month's column begins a series that explores your printer's intelligence — why it is there, where it came from, how it works, what you can do with it, and how to use it. This is a large topic that cannot be covered quickly or absorbed easily; as a result there will be occasional "breaks in the action" to cover other topics of interest, new products on the market, and other items that may come along.

Your printer's primary job is to put characters on paper and to move the paper and its own printing components in such a way that words, sentences, or numeric tables are formed. You could accomplish the same task by writing the characters out by hand, or do it very neatly and legibly by typing them with a typewriter.

A typewriter is, in fact, your printer's oldest living relative, and many of the technical features of these venerable machines have found their way into today's microcomputer printers. Let's take a brief look at typing.

When you type on a typewriter you press a key (you really have to mash the key if it's an older manual model!) and the machine responds by printing a character on the paper in its carriage. Strike another key and another character is printed. Press the space bar and the carriage or printing ball (or other device) advances without printing; press the return key and the typewriter sets the paper for a new line.

You can do the same things with your pc's keyboard and printer. Try this out to prove it to yourself: At the PC-DOS prompt type:

```
A>COPY CON: LPT1:
```

The *copy* command is generally used by PC-DOS to transfer a file from one place to another. PC-DOS thinks of the keyboard-video display combination as a file named "Con:"; in response to your command it copies Con: to your printer, which it thinks of as a file named "Lpt1:". In this way your keyboard can become attached to your printer, much as a typewriter's keyboard is attached to its printing element. Each time you press a key on your pc, the corresponding character will appear on your video display, indicating that you are entering data into the file named Con:.

Because of the way the *copy* command works, your printer doesn't begin "typing" until you close the Con: file by pressing the F6 key (or typing a control-Z). So, type *The quick brown fox jumped over the lazy yellow dog* — or whatever. You can correct errors with the backspace key and type new lines by using the enter key. You can even use the tab key if you want (PC-DOS sets the tabs at every eighth space, and your cursor will move accordingly). Once you have all the lines you wish to have "typed" displayed on your screen, press the F6 key (and then the enter key to tell PC-DOS that you're done). Your printer will start chattering along, "typing" your keyboard input.

This is certainly not the way your printer or your computer were designed to be used, but it does show that your pc and its printer can be used much like a typewriter.

There are a few differences between using the typewriter and using your pc and its printer. Let's look at those differences.

Each time you press a key on a typewriter, its corresponding character is transmitted directly to paper by means of some type of printing mechanism. Indirectly you were able to achieve the same results with your pc and its printer. With the pc, however, nothing happened until you closed the Con: file, because your printer did not receive any instructions until then.

Some other differences should also be noticeable. For example, your backspacing didn't cause the usual mess on the paper that you get when using a typewriter (self-correcting models excluded). Your printer also somehow knew when to return its carriage or print head and move the paper to a new line. If your printer has a horizontal tabulation capability, it probably knew which column position to move to if you used the tab key while entering your text data.

How did it know all of this? You weren't telling it directly by pressing the keys as on a typewriter. You had already done all of that before you pressed the F6 key.

What happened was this. When you closed the Con: file by pressing the F6 key, the PC-DOS *copy* command took over. Since it was instructed to copy Con: to the Lpt1: file, it sent the data to your pc's

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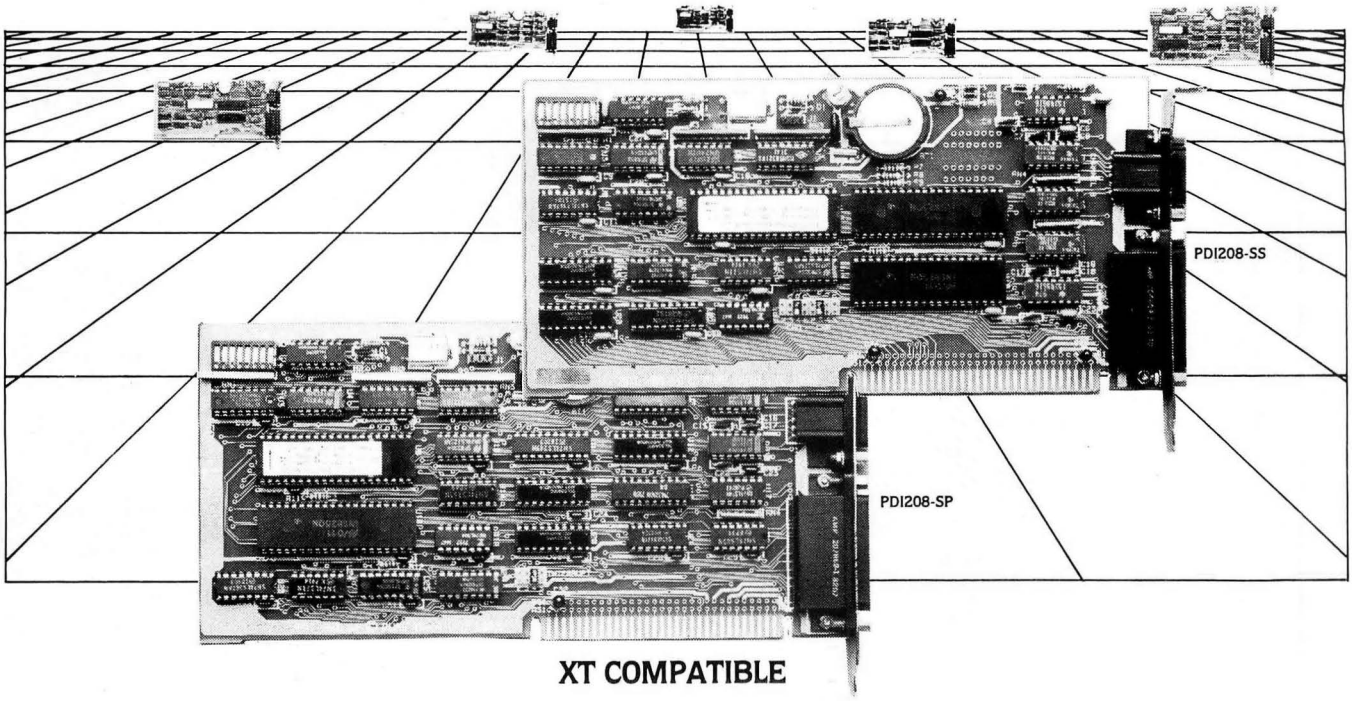

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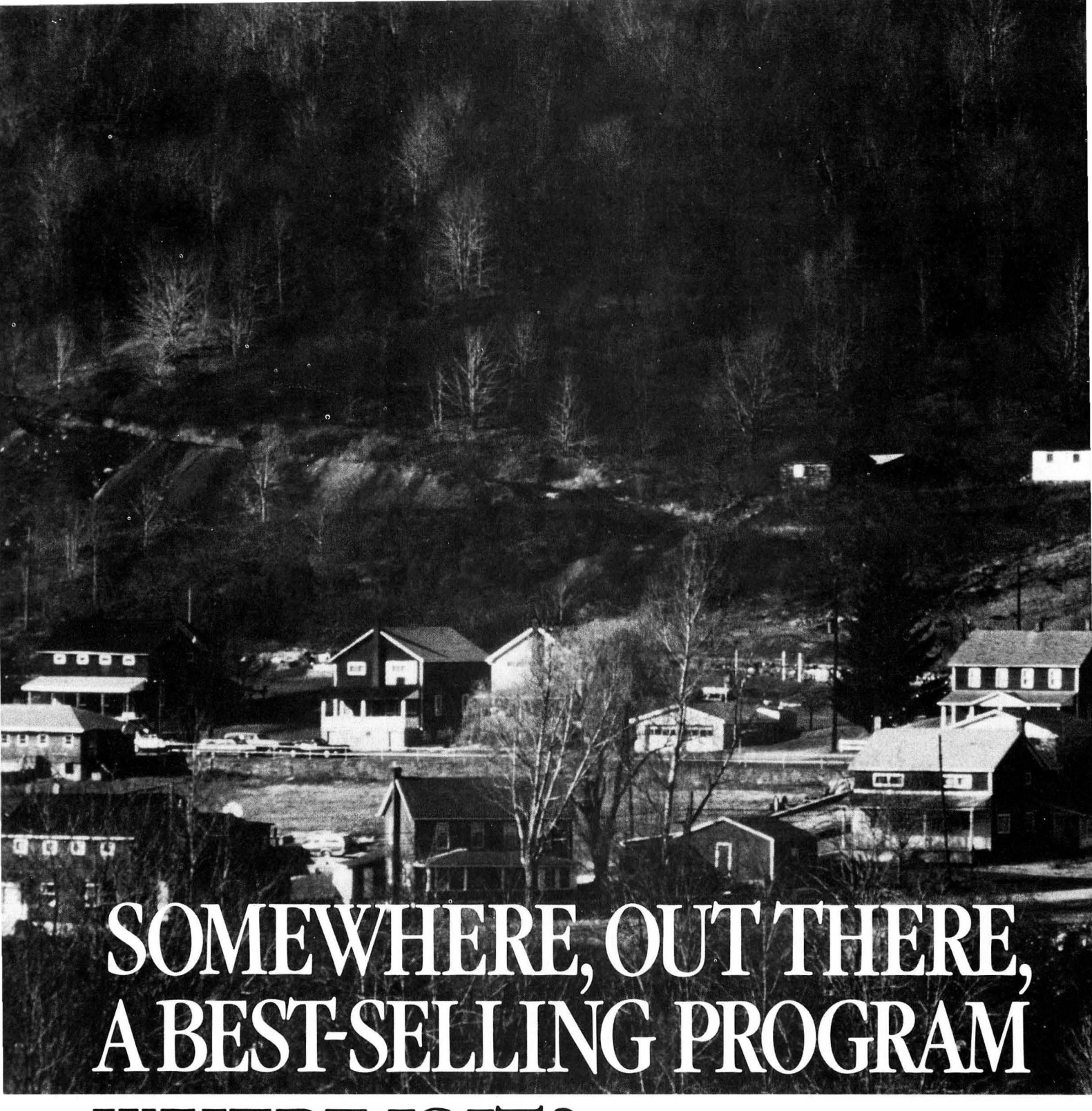

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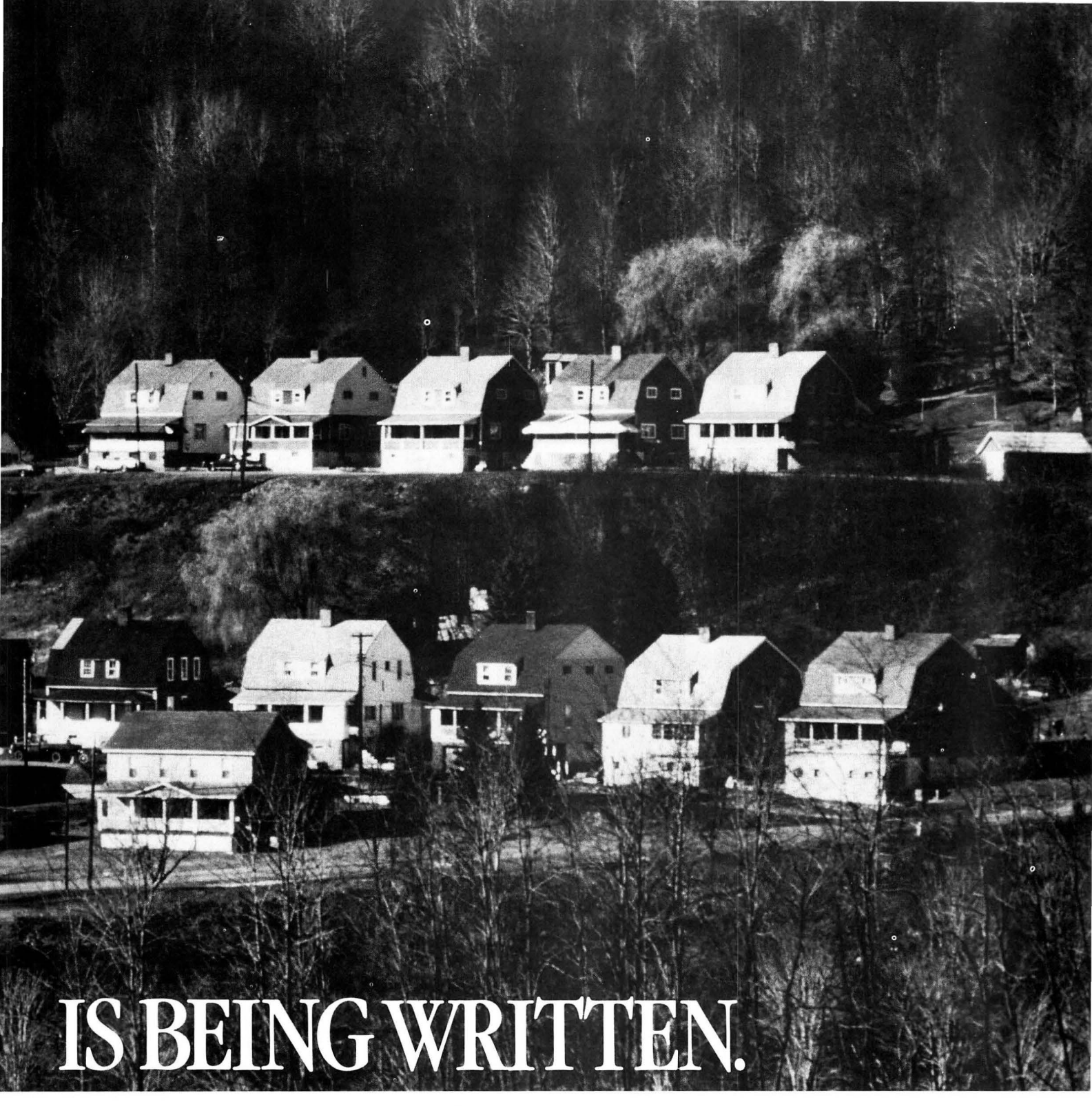

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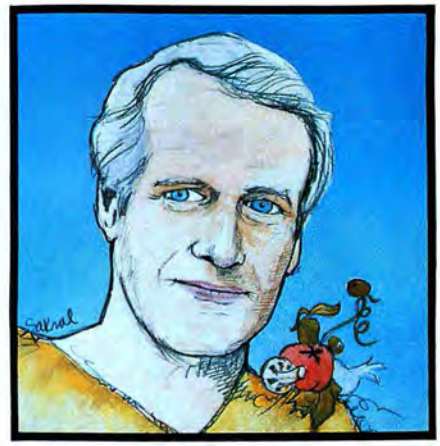

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printer. Why? Because Lpt1: is a reserved filename, known to PC-DOS to be your printer.

So far, so good, but what made the printer print? We previously mentioned a "sequence of instructions" going from your pc to the printer. The data copied from Con: to Lpt1: is that sequence of instructions. To your printer, each character of data received by way of the *copy* command is an instruction.

Each instruction tells the printer to print a character, move the paper, move the printing mechanism, or take a special action (more about special actions later). How does your printer know which to do? Inside your printer is a computer — yes, a computer — that is programmed to know what to do with each data item it receives.

This really isn't any different from how your pc or any other computer works. What we think of as instructions are represented by data inside the computer. A computer knows to treat some data as processing instructions and other data as items to be processed by those instructions. So does your printer's computer.

Suppose for a moment that all we had typed before was the word *Softalk*. After we had entered the data and closed the Con: file, the instruction sequence sent to your printer would have looked like this:

083 111 102 116 097 108 107 013 010

If you look these numbers up in an ASCII character code table (like the one in Appendix G of your IBM Basic manual), you will find out that the first seven codes spell *Softalk*. (Internally the data is represented in binary, but we can ignore that for now.)

The instruction sequence, however, contains nine, not seven, ASCII codes. What are the last two? The first, 013, is the code for "carriage return" (usually referred to as CR), and the second, 010, is the code for "line feed" (LF). How did these two get there? When you press the enter key on your pc the two-code sequence (CR,LF) is always generated. This is the standard ASCII way of ending a line, and your pc conforms to this standard.

Because of the cooperation between your pc and your printer, the *copy* command passes these codes to the printer along with the rest of the instructions. Your printer, in turn, knows to take appropriate action, in this case to return the carriage or print head to its home (left) position and move the paper up one line space.

Let's interpret this instruction sequence as your printer would:

Step 1: Print character "S"
Step 2: Print character "o"
Step 3: Print character "f"
Step 4: Print character "t"
Step 5: Print character "a"
Step 6: Print character "l"
Step 7: Print character "k"
Step 8: Return carriage to home position
Step 9: Move paper up one line space

The actual program that runs your printer looks less like this interpretation and more like a modern structured program. The printer's computer is, after all, a very modern microcomputer. If your printer's program were written in Pascal (it's almost certainly not, but we're allowed some poetic license here), this sequence of instructions might be programmed like this:

```
if printable_code then print_a_character (character_code)
else take_an_action (character code);
```

In our hypothetical Pascal program, *character_code* is an integer variable defined to be the instruction sent to the printer from your pc, and *printable_code* is a Boolean variable that indicates to the printer whether to print the character represented by *character_code* or take an action represented by *character_code*. The two procedures, *print_a_character* and *take_an_action*, which are defined elsewhere, tell the printer exactly how to carry out these tasks. We'll cover these procedures later on in this series.

How would the printer's program know if *printable_code* is true or false? In an earlier column we referred to the fact that all pc-compatible printers print in the normal printable range of the ASCII character set (characters 32 through 126). The characters below ASCII 32 are usually categorized as *control characters* or *control codes*. Some (but by no means all) of them have become computer industry standards over the years. In our simple example, the codes for CR (013) and LF (010) are quite standard.

In general (but not always!), your printer will consider all characters whose ASCII codes are below 32 to be control characters; characters whose codes are between ASCII 32 and ASCII 126 will normally cause

the printer to print a character. Our Pascal program, then, could be expanded as follows:

```
if character_code >= 32 and character_code <= 126
then printable_code := true
else printable_code := false;
if printable_code then print_a_character (character_code)
else take_an_action (character_code);
```

If your printer has minimal capabilities, only a few of the codes below ASCII 32 will be defined. All printers have the CR and LF codes defined. Nearly all printers also include a form feed (FF) code (012), which advances the paper one form, or page, in the carriage. Many printers include other control codes, and the following table defines a more or less normal set found in pc-compatible printers:

ASCII CODE	NAME	MEANING
007	BEL	Sound horn, buzzer, or bell
008	BS	Move print mechanism backward one space
009	HT	Move print mechanism to next horizontal tab stop
010	LF	Feed paper one line space
011	VT	Move paper to next vertical tab stop
012	FF	Feed paper one form (page) length
013	CR	Return Carriage to home position
024	CAN	Cancel print line

You might reasonably wonder what happened to those ASCII codes between 0 and 31 that aren't shown on this table. Part of the answer is that printers use some of the other codes for various purposes, which we'll cover further on. The greater part of the answer is in the evolution and use of the ASCII control codes.

Prior to the evolution of microcomputers, the primary use of ASCII control codes was in telecommunications applications, principally time-sharing terminals hooked to mainframe computers via telephone lines. The codes have also been heavily used (and developed) for communications over teletypewriter networks, such as TWX and Telex.

In the telecommunications environment most of the other control codes are used to indicate such items as where transmitted data starts and stops, where a transmitted file begins and ends, and other information critical to the successful transmission of data. Those of you whose pcs are set up for telecommunications will use those codes in that environment. They are not necessary for printing applications, so most printers just ignore them. (While they could have other applications in printing, most printer designers refrain from using them in order to stay consistent with ASCII standards for data transmission.)

Let's upgrade our hypothetical Pascal program a little more. Since there's no point in executing the *take_an_action* procedure if our printer cannot respond, the program can now be:

```
if character_code >= 32 and character_code <=127
then printable_code := true
else printable_code := false;
if printable_code then print_a_character (character_code)
else if [character_code = 007
or character_code = 008 or character_code = 009
or character_code = 010 or character_code = 011
or character_code = 011 or character_code = 013
or character_code = 024]
then take_an_action (character_code);
```

(Pascal purists will note that the program can be made "cleaner" by use of a Pascal *set* construction. Since this is a hypothetical program anyway, we opt for presentation clarity over code purity.)

You will notice that the simple job of printing the characters *Softalk* on a piece of paper has become a somewhat complex program. Stick around — by intelligent printer standards things are quite simple.

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Let's return to our pc "typing" environment for a moment. In the "Softalk" example the CR and LF codes were generated for us by the pc's enter key. If you used your pc's tab key when you typed data into Con: the HT code was also generated and was used by your printer if it is capable of tabbing.

If you used the backspace key, however, the BS code was *not* sent to your printer. Why not? The data-entering capability provided by your pc's keyboard-video display combination used the BS code entered at the keyboard to wipe out the character you backspaced over. The erasure occurred in the area of memory allocated to the Con: file, and so the character was deleted from the sequence of instructions *before* it was sent to your printer.

This is a very primitive example of intelligent cooperation between your pc and printer. In this case there was no point wasting the printer's time by asking it to process the BS instruction, so the pc took care of the matter ahead of time. The environment used in our pc "typing" example is, in fact, a very rudimentary sort of word processor. It processes text data and "cleans" it before typing it out on your printer.

You will also notice that everything that you did while "typing" on your pc you could also have done on a typewriter. In fact, it might have been easier doing it on a typewriter, since you wouldn't have had to bother hitting the F6 key to close the Con: file or issuing the *copy* command in the first place. If you look at the table of control codes printed above you will see some things in it, such as the FF code, that don't have typewriter equivalents. The only way a typewriter can skip to a new form (page) is by having you repeatedly press its return or index key, or turn the carriage knob, until the old sheet comes out.

How can you tell your printer to use an FF code from your pc's keyboard? It's really quite simple, but it may not sound that way the first time you try it. At the PC-DOS prompt type:

```
A>COPY CON: LPT1:
```

as you did before. Type whatever you like *(Softalk,* or *The quick brown fox . . .).* Make new lines, backspace and tab, just as you did before. Before you press the F6 key to close the file this time, try something different:

* **Press, and hold down, the alt key.**
* **Using the numeric keypad on the right of your keyboard, press first the *1* key, then the *2* key.**
* **Release the alt key.**

Press the F6 key to close the Con: file, and your printer will begin "typing" as it did before. This time, however, after your text has been printed a form feed will occur. You caused the form feed to occur when you entered the alt-12 combination into your Con: file.

How? The alt (it stands for *alternate*) key is a special shift key. When used in combination with the numeric keypad (in most applications), it will generate ASCII character codes directly. If while holding down the alt key you press *6* and the *5* on the numeric keypad, an *A* will appear on your screen as soon as you release the alt key (the ASCII code for *A* is 065). This procedure does not work with the number keys at the top of your keyboard.

After your printer is finished, you will find the paper positioned eleven inches (standard paper length) from where it was when you switched your printer on — if your printer uses continuous-form paper. If your printer uses regular paper you should insert a new sheet — the old one will have rolled out of the carriage!

This month we've started to see what's involved in making an intelligent printer work. And, while the form-feed capability of your printer doesn't represent a quantum leap over the capabilities of a typewriter, it's a step in that direction.

Next month we'll take the matter a step or two further. When we do, we'll have to face the biggest bugaboo of all in printer intelligence — the infamous "Escape Sequence." ▲

NEWSPEAK

HIGH-TECH SPORTS ART

Phone Bills And Modems PBS and Computers ...and More!

WEST COAST COMPUTER ARTIST CREATES SPORTS "PAINTINGS"

It was nearly one hundred degrees in the shade, August 6, 1983, at the Riviera Country Club in Pacific Palisades, California. To the thousands of golf enthusiasts gathered to watch the 1983 PGA Tournament, the weather was just perfect.

Reporters and photographers representing all aspects of the media were here for this momentous sporting event. Even the Goodyear blimp was on hand, sailing serenely overhead through the clear blue sky.

But one exciting story didn't happen on the fairways and the greens. In a small tent near the tenth hole, a talented and energetic artist generated "instant computer art" depicting this sporting event.

The only artist currently re-creating live sporting events as computer-enhanced video paintings, Joni Carter uses what she calls "a one-hundred-and-fifty-thousand-dollar paint box."

Carter's paint box surrounded her at the Riviera Country Club that balmy, sweltering southern California Saturday. Four video monitors displayed the image fed from a television network, her computer's color palette, the "painting" she was currently working on, and the final video image output. A Sony three-quarter-inch video recorder captured each moment of play, ensuring that she wouldn't miss a portentous putt. The computer, an Aurora Imaging System, sat nestled in the corner, amid the road cases and cables.

"What I'm actually doing," Carter explains, "is grabbing frames, digitizing the video input as the golfers are making their shots, and then going back and painting over the image with the computer.

"There are only two types of systems in the country of this caliber—the Aurora and

GOTO page 182, column 2

25 YEARS AND NASA STILL HAS THE RIGHT STUFF

October marks the 200th anniversary of manned flight—on October 15, 1783, Frenchman Jean Pilatre de Rozier made the first captive-balloon ascent. October also marks the twenty-fifth anniversary of the National Aeronautics and Space Administration (NASA), which began operations on October 1, 1958—362 days after the historic launch of Sputnik 1 by the Soviet Union on October 4, 1957.

Since the October 11, 1958, launch of Pioneer 1, a craft that reached an altitude of 71,300 miles, NASA has piled up an impressive list of accomplishments—from planetary probes and Skylab to lunar landings and the current space shuttle program. With the ninth space shuttle mission—which will mark the return of the S.S. *Columbia* carrying Spacelab 1—scheduled to launch on October 28, this month promises to be a time of nationwide celebration of NASA's achievements.

NASA may be experiencing pressure from competitors—the Europeans and the private sector—and one still hears more about potential projects than those that have actually reached fruition, but the U.S. government agency has earned a pat on the back.

Throughout the country, many special celebrations are planned for NASA employees. Employees who were with NASA on October 1, 1958, will be in the spotlight. Also slated are more public-oriented festivities at some of the agency's ten field installations.

Tooting its own horn, NASA is participating in the October 16 premiere of the new film *The Right Stuff*—based on Tom Wolfe's bestselling book on the early days of space flight—and in numerous other projects. An hour-long multimedia show recounting NASA's achievements will be made available to planetariums across the country; a record

GOTO page 186, column 2

New PBS Series Focuses On Educational Computing

At the dawn of the microcomputer age, it became painfully apparent to most adults that the younger generation held the hands-down advantage in the computer games department, so that arena was reluctantly surrendered. But what of educational software and hardware? Who decides whether *Zaxxon* or *Math Tutor* will reign? Will the next generation be capable of zapping an alien armada at ten parsecs but be baffled by simple sums and long division?

Not if television has anything to say about it. More specifically, not if a new series, *Educational Computing Profile*, beginning in September on the Public Broadcasting System, has anything to say about it.

Produced by Kentucky Educational Television (KET) in cooperation with the Educational Products Information Exchange Institute (EPIE), the new series consists of nine monthly half-hour segments covering developments in the microcomputer field; each show also features comparisons and evaluations of educational hardware and software.

The series uses a magazine format in which each monthly segment is divided into three sections: trends and news, interviews and commentary, and software and hardware evaluations.

The trends and news section is topical, concentrating on new developments in the microcomputer industry in general and also reporting on new products and bestsellers. Timely news, such as stock quotes or governmental action affecting the industry, is also covered in this section.

The interviews and commentary give designers, manufacturers, educators, and parents an opportunity to discuss the major issues affecting computer education. The open discussion format, according to KET, is geared to provide "lively, intelligent, and frequently conflicting perspectives about the changes the computer age has brought."

The hardware and software evaluations segment is also meant to cover "frequently conflicting perspectives" in its head-to-head comparisons between products. Competing products are compared and evaluated on the basis of features, storage capacity, expansion capability, ease of operation, quality of graphics, effectiveness of documentation, and more. The evaluations section is intended to emphasize the information consumers will need when buying hardware or software.

Product evaluation will not be limited to any specific hardware or software brands or types. One of the first shows features software for the Apple II and Apple II Plus. Later installments will feature evaluations of the Atari 800, TI personal computer, and accompanying software. According to a KET spokesperson, much of the educational software discussed will be for the Apple, "because there's so much of it."

In order to ensure timeliness, the show will be taped only two weeks before it's aired, to allow coverage of the newest software releases and any late-breaking developments in the industry.

EPIE, which is principally responsible for the content of the series, is an educational products evaluation service and a part of the Consumer's Union of the United States, publisher of *Consumer Reports*. Over the past year, EPIE has trained and certified more than three hundred evaluators throughout the country to provide reviews of courseware packages and hardware systems. MT

Old Tariffs May Be New Problems For Modem Users

As the breakup of AT&T continues and we are left to the tender mercies of local telephone companies, a not altogether unexpected hassle may plague residents of some states using personal computers and modems to send and receive data.

The hassle will take the form of higher telephone bills resulting from "information terminal tariffs"—special telephone rates begun during the 1960s by some of AT&T's operating companies for the use of their lines in data transmission.

The tariffs apply in several states, mostly those served by Southwestern Bell, Mountain Bell, and Southern Bell, but few private owners of personal computers have actually been billed under them.

A case in point was reported in a recent edition of the *Wall Street Journal*. Robert Braver, a personal computer owner in Oklahoma City, saw his basic monthly telephone bill from Southwestern Bell balloon from $9 to $45.90 when the phone company found out he was using a modem.

The tariffs took effect before the personal computer revolution, when only businesses

GOTO page 184, column 3

High-Tech Firms Seek Better Image for So. California

The feeling that there's a division between the north and the south may not be as intense within the state of California as it was nationally, say, at the time of the Civil War, but residents of the Golden State tend to maintain a fair degree of separatist consciousness. Long has southern California been treated like a laid-back, vulgar, rich, no-account relation by the culturally inclined residents of the sophisticated north. Since the advent of the information age and the establishment of its high-profile headquarters in Silicon Valley, the north has added high technology to its list of attractions, which also include opera, big bridges, year-round fog banks, and a subway.

Far to the south in Brentwood, California, Steve Panzer and Jeff Weiss, partners in

Left, Steven Panzer, the driving force behind SoCal TEN. Right, Walter F. Bauer, chairman.

the management consulting firm of Panzer Associates, came to a realization. Specializing in high-technology companies, they had occasion to note that 80 percent of all California-bound venture capital was finding its way up to the northern region, to the dismay and resentment of the businesses in the south. This trend was due to the firm identification of the San Francisco Bay Area—in the minds of investors, venture capitalists, and loan officers—with all things computerized. The folks up north had the image, and they had the community. Everybody knew everybody else.

After doing a little research, Panzer Associates determined that the southern California computer community's lack of identity and visibility is attributable to the fabled Los Angeles Syndrome—the general absence of a sense of community. Unlike the East Coast MIT computer mafia or the Silicon Valley old-boy network—where most companies are spin-offs of companies down the block—southern California's high-tech firms are simply too diverse. They have been founded by people who come from such backgrounds as aircraft engineering, electronics, show business, telecommunications, and so on. However, the fact that there are so many different areas of specialization also means that there is almost no direct competition among firms. Therefore, reasoned Panzer and Weiss, getting people together shouldn't be too difficult.

As a beginning, the partners talked to twenty-five executives from software companies, peripheral and microcomputer manufacturers, distributors, and OEMs. They found an interesting pattern. "For every CEO who raised a problem, another CEO had found the solution," says Panzer. "Where one CEO was weak in marketing, at the same time he was strong in financial management. Perhaps the most significant finding was that all the CEOs taken together had virtually all the solutions."

And, just as important, "They really wanted to talk to us," recalls Weiss. "They were eager to hear from someone outside."

Panzer and Weiss's objective was to form a network of information—not to ferret out technological trade secrets, but to supply help in managing companies, building relationships in the business, and generally increasing the public's awareness of Southern California as a bustling center for high technology. Deciding to go further than Silicon Valley's tight-knit but informal network, Panzer and Weiss founded the Southern California Technology Executives Network (SoCal TEN).

By the first organizational meeting in May, the group had the attention of forty-seven area companies, including Ashton-Tate, Datamost, Datasoft, Edu-Ware, Micro/Sys, Callan Data, Corona, and Axiom. At the first official meeting in July, over a hundred companies were represented. At that gathering, two venture capitalists and the CEOs of two fast-growing companies delivered keynote speeches on dealing with marketing problems. Then the meeting broke up into round-table discussions.

Now, by providing a monthly summary of information from management, technical, and market sources, a schedule of network conferences and seminars, and a membership resource directory, SoCal TEN is helping to

GOTO page 184, column 3

«Paintings»

continued from page 179

the MCI/Quantel Paintbox," says Carter. "The two are radically different. The Aurora is a fabulous system to take on site because it's quick and totally dependable."

At an event like the PGA Tournament, some of the final images are sent back out to the television network. Other computer paintings may be patiently modified, pixel by pixel, until Carter is ready to convert them to hard copy. These latter works become either gallery pieces or limited edition prints. Carter produced a limited series of paintings from this year's PGA Tournament.

"If I'm creating a piece of artwork that I definitely want to reproduce for a gallery, then obviously I give myself a great deal more time. If I'm creating artwork for broadcast on television, that's something entirely different."

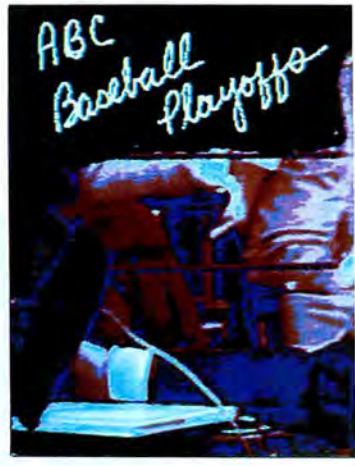
A self-taught artist who has sold numerous pieces of art—including lithographs and silkscreens, as well as computer paintings—Carter looks upon the technology she now employs as a tool for creative expression. "These systems are really more for the artist than for the technician; they're very simple to use."

Carter, using a graphics tablet, can adjust the luminance and hue levels of a single color, producing hundreds of shades of that color. The system Carter uses also enables her to achieve multiple shades of flesh tones with ease.

"When I used to paint, I would sit for hours mixing little dabs of paint. There might be seventy-five shades of color in a face. The computer will give you the same range of colors instantly."

You'd have to buy a lot of paint to equal the total number of colors possible on the Aurora's color palette, an astronomical sixteen million.

Carter's portfolio of "Instant Replays" of major sporting events includes the Major



Clockwise from upper left: Carter's Paintbox rendering of a racehorse; the moment after the winning shot at the 1983 PGA Tournament; a scene from last year's Bay to Breakers marathon; Carter's self-portrait circa last fall. Below, the 18th hole at the Riviera Country Club as interpreted on the Aurora.

League Baseball play-offs aired on ABC last October. "There, I worked ten days live, hooked up via satellite to both the National and the American League games."

Carter has also created on-the-spot art for display on Dodger stadium's Diamond Vision screen. And she has done "instant computer art" for the NFL and the NBA, as well as for marathons, such as San Francisco's Bay to Breakers '82 race.

Working with television live on location poses its own unique problems. The bright sunlight reflecting off her monitors makes them difficult to read and, as in all live productions, timing is critical. Some of Carter's paintings have had to be digitized, touched up, and ready to air in less than three minutes. "The last time I worked for ABC," Carter recalls, "they just broadcast the paintings alone. They didn't use them for bumpers, backdrops, or logos. They used them as pieces of art at the end of every inning during the baseball play-offs."

Carter created more than two hundred twenty pieces of art during the play-offs, and ABC used about seventy-five of the paintings. In the last game of the National League play-offs, ABC finished the broadcast with her portrait of Ted Turner, owner of the defeated Atlanta Braves.

Working with television has offered Carter many opportunities for creative experimentation, not just in the direct broadcast of her computer paintings.

"When I first discovered the computer, one of the things I started creating was hard copy as artwork. I sold prints to some of the studios for use on a variety of sets.

"It was a fabulous experience," recalls Carter. "Art directors and set decorators would say, 'Joni, we've got a set that needs some flower designs. These are the colors...' I would run over to the computer and create some bizarre flower designs. Then the AD [art director] would come back at the last minute and we would play around with the designs and the colors. We might get twenty-five different pictures from that one design."

Carter uses a process that results in a Sepichrome print, which bears more resemblance to an oil painting than it does to a conventional computer printout. The process involves using a special computer/camera, which takes a direct RGB signal in and converts it into thirty-five-millimeter slides. The slides are then made into prints by a local graphics printing firm.

A problem Carter faces from time to time is equipment incompatibility. "You can do the greatest piece of artwork in the world on the computer. Then it comes time to hook up

GOTO page 184, column 2

Above, Carter's MCI/Quantel Paintbox rendering of swimmer. Left, a moonlit skiing scene created with the Aurora.

«Paintings»

continued from page 183

the computer/camera and it doesn't work. You wind up with a not-so-good print. Sometimes you're fighting technology the whole way."

With the aid of her sister Kate Richardson, who is vice president of Carter's company, and Aurora engineer Todd Hitzeroth, Carter is currently involved in a major project at the Museum of Science and Industry in Los Angeles, her base of operations. The group is preparing what is expected to be the world's largest "hands-on" computer graphics display, scheduled to be ready early next year. The display will feature graphics generated on a host of different computers from Apples and Ataris to Auroras and Quantels and will be simple enough for children (and even adults) to use.

Also in the works are plans for the 1984 Summer Olympics. Carter intends to have pictures from all the Olympic sites transmitted to the museum as the events take place. She also plans to paint a special series of Olympic scenes for display on monitors throughout the museum. HS

Image

continued from page 181

remove the proverbial chip from southern California's high-tech shoulder.

Having focused initially on the western portion of the San Fernando Valley—where many computer peripheral manufacturers are concentrated—SoCal TEN now covers all of Los Angeles County and has plans to draw Orange County firms into the network soon.

Panzer Associates is continuing its research, in an effort to "identify the critical factors in the management of rapid growth and marketing strategies," says Panzer. "We are exploring the possibility of a 'corporate university'—a place where executives and managers could learn from the seasoned leaders, and where we could all learn from each other." AC

Tariffs

continued from page 180

were transmitting data by phone. Local telephone companies say the rates are higher than ordinary residential rates because sending and receiving data involves heavier use of the lines.

Braver, meanwhile, is organizing a fund-raising campaign to mount a legal challenge to the tariff, based on the argument that personal computer owners use their modems far less than a business would. He's making contacts fast with potential contributors—via modem, of course. DH

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The Leader in Software Production Technology.

NASA

continued from page 179

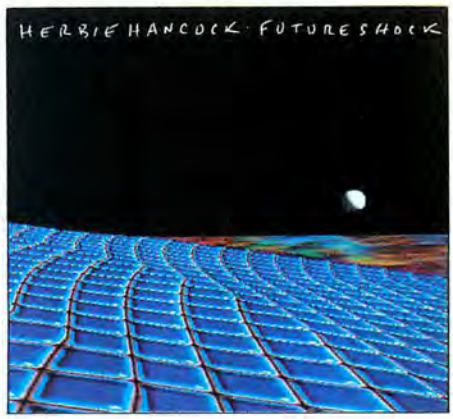
book illuminating NASA's past history and future plans will be distributed to more than fifty thousand science teachers in mid-October; and stamp collectors will have a chance to purchase some of the two hundred sixty thousand postal covers carried on the last shuttle flight (the covers have a Twenty-fifth Anniversary NASA cancellation mark).

With the space shuttle program running fairly smoothly and with several projects—the Galileo Jupiter probe, the Space Telescope, and a possible orbiting space station—on tap for the near future, NASA is forging ahead. All of us earthbound folks have benefited greatly from the efforts of this organization and if the past is any indicator, we should continue to do so in times to come. DH

Δ **"I Still Have the Utmost Confidence in This Mission."** MGM/UA has announced plans to film Arthur C. Clarke's bestselling sequel to the film and book *2001: A Space Odyssey.* According to a two-page ad in *Daily Variety, 2010: Odyssey Two* is scheduled to be completed in time for a Christmas 1984 release. That's fourteen months from now. The first film took almost three years to make. Assuming the filmmakers follow Clarke's book, which has been in bookstores almost a year now, the film *2010* will mark the return of HAL (you remember HAL) to the big screen. What happened to HAL after he burbled out "Daisy" and promptly went to supercomputer heaven? Well, you can wait a year and a quarter and see the movie, or you can read the book.

Δ **Get Out Your Slide Rules.** Will the Japanese computer invasion become the Japanese abacus invasion? Not likely, but the *soroban,* or abacus, is enjoying a surprising comeback in Japan. Apparently, dozens of corporations are sending their employees to *soroban jukus*—cram schools—for refresher courses. Experienced users can shift the beads of an abacus back and forth faster than they can push the buttons of a calculator. Winners of a recent national soroban championship solved twenty problems, each involving addition of twenty eleven-digit numbers, in less than five minutes.

Δ **And On the Future Music Scene.** In May 1983, *Softalk* (for the Apple computers) visited with jazz and funk musician Herbie Hancock, who at the time was working on a new album. Well, that album is now in the stores; it's called *Future Shock* (Columbia Records) and features six tracks. Hancock is not the only musician on the album, but his multi-synthesizer keyboard playing is evident in every cut. A richly layered dance album, with bopping rhythms and only occasional vocals, *Future Shock* finds Hancock using a

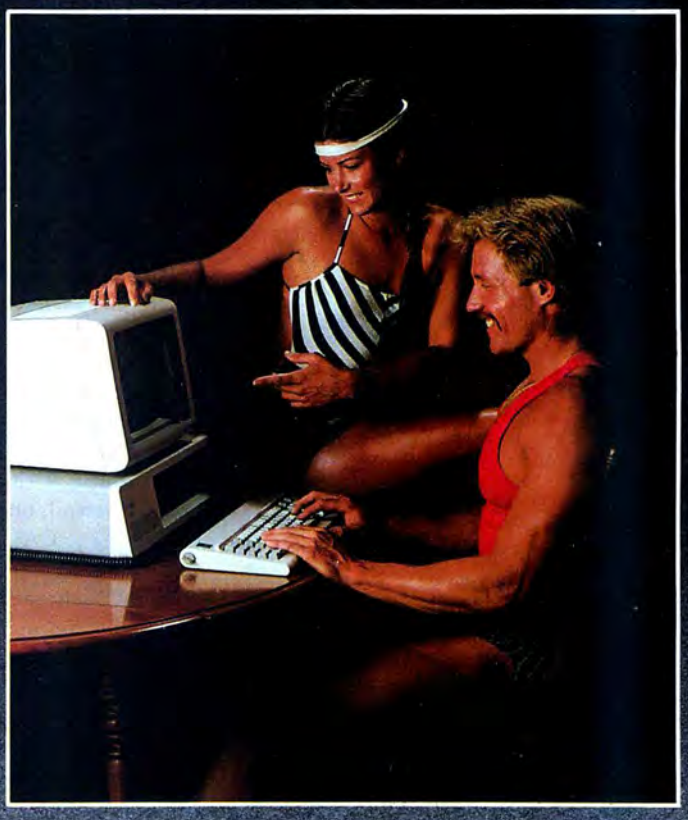


host of different synthesizers—the Rhodes Chroma, Mini-Moog, Yamaha GS-1, alpha-Syntauri, and several others. Hancock effortlessly mixes these modern sounds with live and electronic percussion, live and vocoderized vocals, and even occasional sprinklings of acoustic piano. The result is a fascinating, sometimes exhilarating journey through the musical world of synthesized funk.

Δ **Tubular Computer Shopping Malls, Part Two.** AT&T Information Systems is one of about three hundred fifty high-tech companies leasing space in Infomart, a new market-support center for the information processing industry. Presently under construction in Dallas, Texas, Infomart is scheduled to open in the fall of 1984. The 1.5-million-square-foot facility will house the permanent showrooms of such companies as AT&T and will also offer a continuous schedule of trade shows, seminars, symposiums, and meetings directed to specific high-tech industries and product areas. Infomart is being built to resemble London's Crystal Palace—one of the most successful merchandising exhibit facilities in history—and is part of the 185-acre Dallas Market Center, which features 7.6 million square feet of display and demonstration space serving seven basic industries.

Δ **Sheep Shearing Robot.** Australia relies on wool as one of its biggest export industries. With nine times as many sheep as people, Australian researchers for years have been trying to develop better, faster ways to shear sheep, but progress has been slow. Recently, the University of Perth announced the development of a robot that can shear 80 percent of a sheep's body with the help of what devel-

Help Yourself



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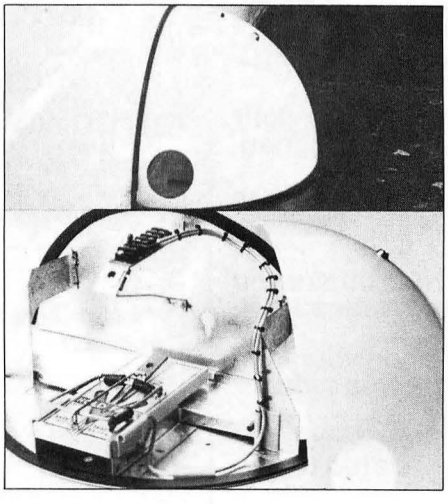
opers are calling "Software Sheep." A program tells the robot—an industrial robotic arm normally used for welding—how to guide the shearing razor over the body contours of an average sheep. To compensate for the individual peculiarities of a sheep, the automated system takes different body measurements of the sheep before the animal reaches the robot. Also, sensors on the robot arm provide a warning if the razor head gets too close to the sheep's skin. Researchers have yet to program the robot to shear the more sensitive parts of a sheep, the head in particular. Also, the robot works about a tenth as fast as an experienced human shearer. Developers of the system say it will be another ten years before the system is available commercially.

Δ Eighty-Five Years Later and Finally a Better Mousetrap. So you thought you knew all about RAMS and CPM? Well, you may be in for a surprise. RAMS (Rodent Activity Monitoring System), offered by Ace Pest Control (Culver City, CA), is the key element in a computerized service called CPM (Commercial Pest Management). Designed for businesses that normally have problems with insects, rodents, and other pests, RAMS automates the routine job of checking traps. Conventional trapping devices, such as snap traps, glue boards, and Ketch-Alls, are housed in a protected monitoring device, which is connected to a digital "activity transmitter." Whenever a trap is disturbed or sprung, the activity transmitter sends a message to a central computer at Ace Pest Control. An Ace technician then empties the traps and records in a CPM report such information as the date, infestation, location,



and type of pesticide used in each part of a building. This information is kept in the central computer, providing a permanent log of a company's pest control program. According to Ace, trends become immediately evident. The idea is to identify trouble areas and follow through with preventive measures. Mickey and Minnie, consider yourselves forewarned.

Δ A Must for Satellite Heads. The Public Service Satellite Consortium (PSSC) is holding its eighth annual conference and exposition October 18–21 at the Washington Hilton Hotel, in the nation's capital. The first day's program is aimed at lending officers, banks, insurance companies, venture capitalists, public service organizations, and other interested investors. The conference will also look at direct broadcast satellites, satellite teleconferencing, launch risks, recent disasters and how they can be prevented, and new satellite systems. Contact the PSSC in Washington, D.C., for details.

Δ SM (Science Museums) and Ex-Slaughterhouses. In the mid-seventies, a large, multistory abattoir on the northern edge of Paris was built, but never put into operation; new meat-processing and transportation techniques made the facility obsolete before it was completed. So, the French government decided to convert the unused slaughterhouse into a national science museum. The museum project—the National Museum of Science, Technology and Industry of the Park of la Villette—was initiated in the late seventies and is scheduled to be completed in 1986. The museum will feature four basic sections—labeled *exploring, using and producing, living and inhabiting,* and *communication*—and a total of twenty themes, everything from the human brain and the transformation of matter to computers and the relationship between the arts and the sciences.

Δ CADI and Diabetics. As early as this fall, diabetics will have the opportunity to purchase a hand-held computer to assist in prescribing the proper dosages of insulin on a day-to-day basis. CADI, Computer Assisted Diabetic Instruction, is currently being developed at the University of Alabama in Birmingham's Diabetic Research and Education Hospital. Diabetics spend a week in the hospital to see how they respond to different foods and controlled insulin doses. The test results obtained are fed into a database and programmed into participants' hand-held computers. Patients will have twenty-four-hour-a-day access to the hospital's database via telecommunications. Only two diabetics are in the CADI program now, but twenty-five are expected by year's end. Through more efficient blood sugar control, CADI developers say, diabetics can have a more flexible lifestyle. ▲

Editor **David Hunter**
Contributors **Andrew Christie, Howard A. Shore, and Michael Tighe**

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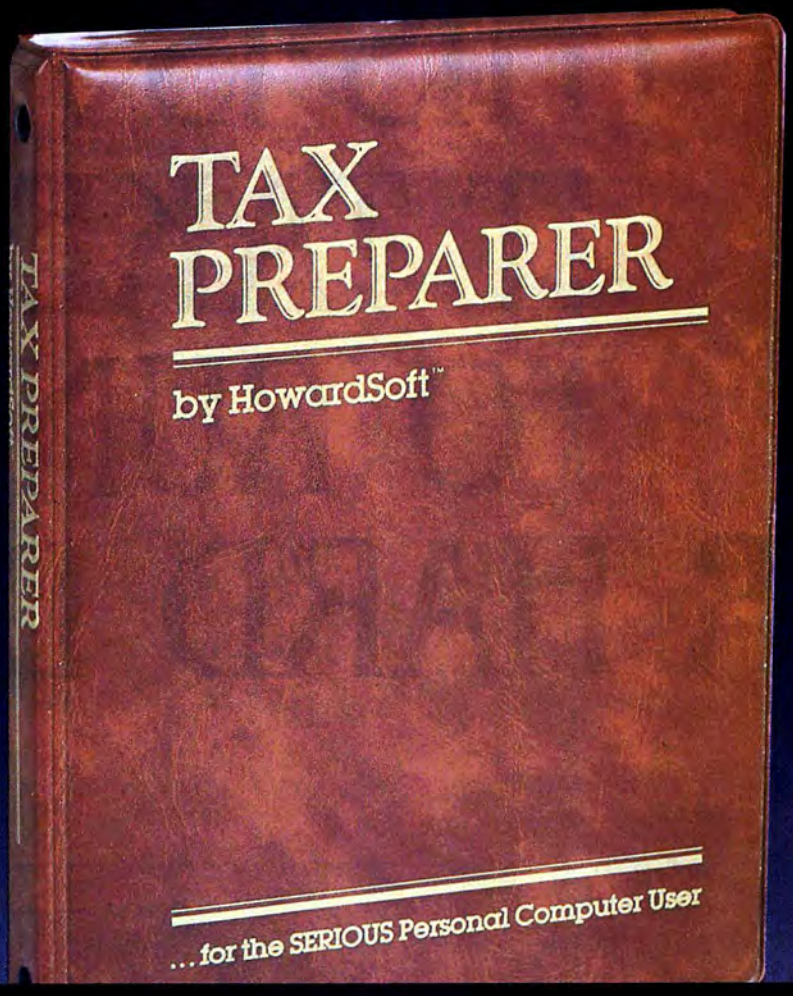

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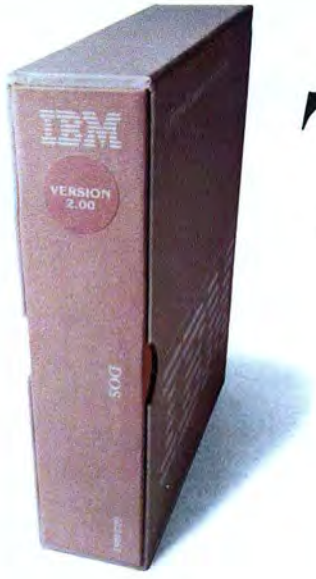

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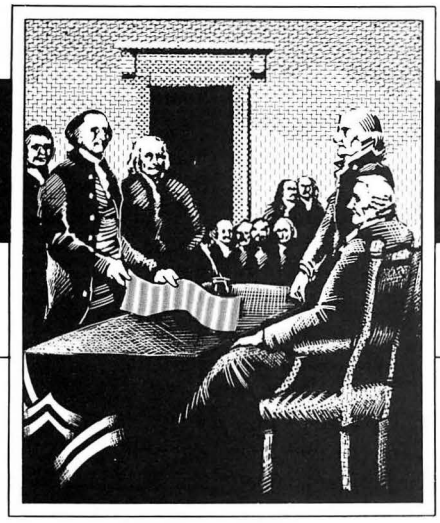

THE RIGHT TO ASSEMBLE

by Ray Duncan

A Program To Set Screen Attributes

This month's little utility program, called CLEAR, allows you to clear the display and optionally set one or more of five screen attributes: reverse video (black on white), high-intensity, blinking, underlining, or "silent" (display off). This facility is useful for inclusion in batch files in situations where you wish to make clean displays, call the operator's attention to an event, or make certain unsightly events invisible. Listing 1 presents CLEAR in a form suitable for use with the IBM *Macro Assembler*.

The CLEAR program is used as a DOS external command in the following form:

A>CLEAR [c,c,c...]

where *c* is one or more characters, in either upper or lower case, from the following list:

- **B Blink**
- **I Intensity**
- **R Reverse video**
- **S Silent (display off)**
- **U Underline**

If no character from this list is given in the command line, CLEAR simply clears the display and sets it to the normal mode—white on black. Characters other than those shown in the list are ignored. Although CLEAR is meant to be used with the monochrome display, the *clear, silent,* and *reverse* functions work exactly the same on both the display adapters. The *underline* function produces a blue-on-black display when used with the color board.

Some of the display attributes can be used in combination. Blink and intensity can be used together and with reverse video.

Here are some examples of the use of CLEAR:

A>CLEAR	**(clears the display and sets normal video mode)**
A>CLEAR BI	**(clears the display and initializes it for blinking and intensified text)**
A>CLEAR R	**(clears the display and initializes it for reverse video text)**

Listing 2 shows the steps you need to follow to assemble, link, and turn CLEAR into a COM file, then to delete the intermediate EXE file. As you did when assembling last month's utility, you will receive an error message from the linker telling you that you didn't allocate a STACK segment; since you are creating a COM file, you can ignore this warning.

When you have finished, copy the executable CLEAR.COM to all your working disks. If you have typed in the source program correctly, the length of CLEAR.COM on a directory listing will be exactly 109 bytes. Compare this for compactness to the SCRATR program in the *Norton Utilities*; this program performs essentially the same functions, is written in C, and occupies 3,426 bytes.

Apart from its value as a utility for batch files, CLEAR illustrates a number of useful techniques for aspiring IBM pc assembly lan-

guage programmers. The general plan of the program is this:

1. Get the current display mode, so we'll know the width of the display (number of columns).

2. If the display is in graphics mode, take no action, just exit.

3. Set the "window" dimensions (to be used in a later call to the ROM BIOS) to include the entire display.

4. Initialize the attribute byte to normal video.

5. Check the "command tail" placed by PC-DOS at 0080H; see if the user entered any command characters following the program name. If none were entered, jump to step 8.

6. "Fold" both uppercase and lowercase command codes into one case before attempting to match them (this is good practice in all programs; it relieves the operator of worry about the state of the caps lock key).

7. For each legal code found in the command tail, merge the proper bits into the forming "attribute byte." A carriage return signifies the end of the command tail.

8. Call the ROM BIOS video driver to initialize the display window with the desired attributes.

9. Set the cursor to the home position (upper left corner).

10. Exit to PC-DOS via interrupt 20H.

By *attribute byte* we are referring to an eight-bit pattern that accompanies each ASCII character byte in the video display's reserved memory area. The CLEAR program sets all attribute bytes for the screen at once; more sophisticated programs can turn on selectively different characteristics to smaller parts of the

```
                                name    clear
                                page    55,132
                                title   'CLEAR—control PC display'
                        ;
                        ; CLEAR Utility to clear display
                        ; and set character attributes
                        ;
                        ; Ray Duncan,  Uncopyright (u) August 1983
                        ; This program may be freely copied,
                        ; mangled, enhanced, redistributed.
                        ;
= 0080          input   equ     080h    ;command line tail buffer
= 000D          cr      equ     0dh     ;ASCII carriage return
                ;
0000            cseg    segment byte
                        assume  cs:cseg,ds:cseg
                ;
0100                    org     0100h   ;since this will be
                                        ;a COM file
                ;
0100            clear:                  ;initialize display...
                                        ;call BIOS video driver to
0100  B4 0F             mov     ah,15   ;get current display mode:
0102  CD 10             int     10h     ;returns AL = mode, and
                                        ;AH = no. of columns.
0104  3C 07             cmp     al,7    ;if we are in graphics modes
0106  74 04             je      clear0  ;(modes 4,5,6) then exit
0108  3C 03             cmp     al,3    ;but if we are in mode 0-3
010A  77 5F             ja      clear9  ;or 7 then continue.
010C            clear0:                 ;set up size of window to
                                        ;be initialized...
010C  33 C9             xor     cx,cx   ;set upper left corner of
                                        ;window to (X,Y)=(0,0)
010E  B6 18             mov     dh,24   ;set Y to 24 for lower right
0110  8A D4             mov     dl,ah   ;corner, and X to the number
0112  FE CA             dec     dl      ;of columns returned by BIOS
                                        ;minus 1
0114  B7 07             mov     bh,7    ;initialize attribute byte
                                        ;to normal video display,
                                        ;i.e. white on black.
                                        ;set SI=address of command
                                        ;tail's length byte
0116  BE 0080           mov     si,offset input
0119  FC                cld             ;clear the Direction Flag
                                        ;for LODS string instruction.
011A  AC                lodsb           ;check length byte to see if
011B  0A C0             or      al,al   ;there's any command tail.
011D  74 3F             jz      clear8  ;no,go clear the screen
                                        ;with normal video attribute
                                        ;
011F  AC        clear1: lodsb           ;check the next byte of
                                        ;the command tail,
0120  3C 0D             cmp     al,cr   ;if carriage return
0122  74 3A             je      clear8  ;we are done.
0124  0C 20             or      al,20h  ;fold the character to
                                        ;lower case.
0126  3C 61             cmp     al,'a'  ;make sure it's in range a-z
0128  72 F5             jb      clear1  ;no, skip it
012A  3C 7A             cmp     al,'z'
```

display. See figure 1 for an explanation of the attribute byte as it applies to the monochrome adapter.

CLEAR makes extensive use of the video driver services provided in the pc's ROM BIOS. This is a set of routines that can be called directly from assembly language programs, via software interrupt 10H. The video driver can be used to clear or initialize the screen, display characters, set or read the contents of pixels, and scroll selected windows of the screen up or down—among other things. See table 1 for a summary of the functions available, the registers used to pass arguments, and the returned values. You will probably want to cut out or photocopy this table for future reference.

Readers interested in a more detailed explanation of these functions (and who aren't willing to wait for it to appear in this column) can refer to my article in *Dr. Dobb's Journal*, July 1982.

The use of the BIOS's video driver has both benefits and disadvantages, like everything else in this cruel world. The video driver offers some pretty sophisticated services, most of which can be invoked without regard to the current display mode (40-by-25 text, 80-by-25 text, or whatever). However, it's relatively slow, partly because of the generality of its routines and partly because of the considerable execution-time overhead imposed by the software interrupt and return sequence. Programs, such as games, that need extremely high-speed display usually write directly into the video interface's memory buffer, by-passing the ROM BIOS altogether.

Just as last month's program, VMODE, il-

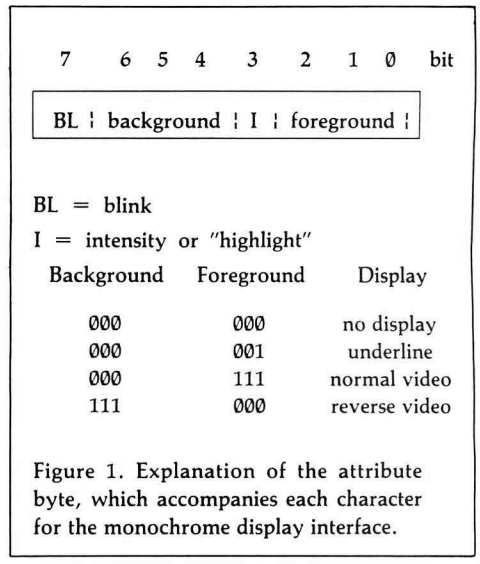

Figure 1. Explanation of the attribute byte, which accompanies each character for the monochrome display interface.

```
012C  77 F1          ja      clear1    ;no, skip it
012E  3C 69          cmp     al,'i'    ;I=Set intensity
0130  75 05          jne     clear2    ;jump if not I
0132  80 CF 08       or      bh,08     ;set intensity bit
0135  EB E8          jmp     short clear1
0137  3C 72  clear2: cmp     al,'r'    ;R=Reverse
0139  75 08          jne     clear3    ;jump if not R
013B  80 E7 88       and     bh,088h   ;mask off old foreground/
                                       ;background bits and
013E  80 CF 70       or      bh,070h   ;change to reverse video
0141  EB DC          jmp     short clear1
0143  3C 75  clear3: cmp     al,'u'    ;U=Underline
0145  75 08          jne     clear4    ;jump if not U
0147  80 E7 88       and     bh,088h   ;mask off old foreground/
                                       ;background bits and
014A  80 CF 01       or      bh,01h    ;change to underline
014D  EB D0          jmp     short clear1
014F  3C 62  clear4: cmp     al,'b'    ;B=Blink
0151  75 05          jne     clear5    ;jump if not B
0153  80 CF 80       or      bh,080h   ;set blink bit
0156  EB C7          jmp     short clear1
0158  3C 73  clear5: cmp     al,'s'    ;S=Silent
015A  75 C3          jne     clear1    ;if not S try next char.
015C  B7 00          mov     bh,0      ;if S command, rig for
                                       ;silent running.  Clear
                                       ;the foreground/background
                                       ;display control fields, and
                                       ;don't bother to look for
                                       ;any more command characters.
                                       ;
015E         clear8:                   ;now we have decoded all
                                       ;the characters in the
                                       ;command tail, and are ready .
                                       ;to initialize the display.
                                       ;BH=    desired attribute
                                       ;CL,CH=(X,Y),upper left
                                       ;       corner of window
                                       ;DL,DH=(X,Y),lower right
                                       ;       corner of window
015E  B8 0600        mov     ax,0600h  ;AH =  function type 6,
                                       ;AL =  lines to scroll (zero)
0161  CD 10          int     10h       ;request initialization
                                       ;of window by BIOS
                                       ;
0163  B4 02          mov     ah,2      ;now set the cursor to
0165  B7 00          mov     bh,0      ;(X,Y)=(0,0), Page=0
0167  33 D2          xor     dx,dx
0169  CD 10          int     10h
                                       ;
016B  CD 20  clear9: int     20h       ;exit to PC-DOS
                     ;
016D         cseg    ends
                     ;
                     end     clear
```

Listing 1.

```
A>ASM CLEAR,CLEAR,CLEAR,CLEAR
A>LINK CLEAR,CLEAR,,, (* the three commas must be as shown *)
A>EXE2BIN CLEAR.EXE,CLEAR.COM
A>ERASE CLEAR.EXE
```

Listing 2. The sequence of commands to follow to assemble, link, and turn the CLEAR utility into a COM file, then to delete the intermediate EXE file.

lustrated the use of the SCAS (Scan String) instruction, this month's CLEAR demonstrates the LODS (Load String) mnemonic. LODS uses the address in register SI (Source Index) in combination with the DS (Data Segment) register to fetch either a byte into AL (LODSB) or a sixteen-bit word into AX (LODSW). It then automatically increments or decrements SI by 1 or 2, for byte or word accesses respectively. Whether an increment or decrement is performed depends on the state of the Direction Flag. It is good practice to explicitly set or clear the flag with STD or CLD instructions before using any string instruction. Don't assume that PC-DOS or any other program has left it in a particular state.

To summarize, the machine instruction:

```
LODSB
```

is really equivalent to:

```
MOV     AL,[SI]
INC     SI
```

So what's the advantage of using LODSB in such a context? Speed and compactness—which are really not very important in the tiny program we are writing here, but can be crucial in other situations. LODSB occupies one byte and takes twelve machine cycles, while the equivalent two-instruction sequence just shown requires three bytes and fifteen machine cycles. It's a little early for you to be counting cycles in this way, but be aware that it can be very important in some routines (such as high-speed graphics displays).

Function 0—set video mode
Call with
AH = 0
AL = 0 40 x 25 black-and-white text, color adapter
1 40 x 25 color text
2 80 x 25 black-and-white text
3 80 x 25 color text
4 320 x 200 color graphics
5 320 x 200 black-and-white graphics
6 640 x 200 black-and-white graphics
7 monochrome adapter text display

Function 1—set cursor type
Call with:
AH = 1
CH = bits 0–4 starting line for cursor
CL = bits 0–4 ending line for cursor

Function 2—set cursor position
Call with
AH = 2
BH = page number (must be 0 in graphics modes)
DH = row (Y coordinate)
DL = column (X coordinate)
Note: (X,Y)=(0,0) is upper left corner of screen.

Function 3—Read cursor position
Call with
AH = 3
BH = page number
Returns
DH = row (Y coordinate)
DL = column (X coordinate)
CH = starting line for cursor
CL = ending line for cursor

Function 4—read light pen position
Call with
AH = 4
Returns
AH = 0 if light pen not down/not triggered
1 if light pen down/triggered
DH = character row (Y coordinate, 0–24)
DL = character column (X coordinate, 0–79 or 0–39)
CH = pixel row (Y coordinate, 0–199)
CL = pixel column (X coordinate, 0–319 or 0–639 depending on mode)

Function 5—select display page
Call with
AH = 5
AL = page number
Note: This function is legal only in text modes on the color/graphics adapter. Page number may be in range 0–7 for modes 0 and 1, range 0–3 for modes 2 and 3,

Function 6—initialize or scroll window up
Call with
AH = 6
AL = number of lines to scroll. If AL = 0, the entire window is blanked
BH = attribute to be used for blanked area
CH = Y coordinate, upper left corner of window
CL = X coordinate, upper left corner of window
DH = Y coordinate, lower right corner of window
DL = X coordinate, lower right corner of window

Function 7—initialize or scroll window down
Call with
AH = 7
AL, BH, CH, CL, DH, CL are used as in function 6

Function 8—read attribute and character at cursor
Call with
AH = 8
BH = display page
Returns
AL = ASCII character code
AH = attribute byte

Function 9—write attribute and character at cursor
Call with
AH = 9
AL = ASCII character code
BH = display page
BL = attribute
CX = count of characters to write
Note: The replication factor in CX only produces a valid result for the current row. All values of AL result in some sort of display; control characters such as carriage return and line feed are not recognized. After a character has been written, you must move the cursor explicitly (with function 2) to the next desired position.

Function 10—write character only at cursor
Call with
AH = 10
AL = ASCII character code
BH = display page
CX = count of characters to write

Function 11—set color palette
Call with
AH = 11
BH = color palette ID being set
BL = color value to be used with that color ID
Note: If BH = 0, BL contains the background color (0–15 in graphics modes, 0-31 in text mode)

Function 12—write graphics pixel
Call with
AH = 12
AL = pixel value (0–1 in hi-res graphics modes, 0–3 in medium-res modes). If bit 7 of AL is set, the new value will be XORed with the current contents of the pixel.
DX = row number (Y coordinate)
CX = column number (X coordinate)

Function 13—read graphics pixel
Call with
AH = 13
DX = row number (Y coordinate)
CX = column number (X coordinate)
Returns
AL = pixel contents (range depends on graphics mode)

Function 14—write text in "Teletype" mode
Call with
AH = 14
AL = ASCII character code
BH = display page in alpha modes
BL = foreground color in graphics modes
Note: Bell code, backspace, carriage return, and line feed are recognized and the appropriate action taken. All other characters result in some sort of display; then the cursor is moved to the next position. Line wrapping is provided: If the cursor is at the end of a line, it is moved to the start of the next line. If the cursor is at end of the screen, the screen is scrolled up and the cursor is placed at the beginning of a new blank line. The display attribute for the entire newly scrolled line is taken from the last character that was written on the preceding line, so watch out!

Function 15—get current display mode
Call with
AH = 15
Returns
AL = display mode (see function 0 for explanations)
AH = number of character columns on screen
BH = active display page

Table 1. Video ROM BIOS service calls

softalk presents the bestsellers

The phenomenon of *MultiMate*, the hot new word processor from Softword Systems, provides a different look at a way to break into the IBM pc marketplace.

Softword couldn't have chosen a worse time to introduce a new word processor. MicroPro is bundling everything except *1-2-3* into a package to support *WordStar*'s market share. Information Unlimited Software was purchased by a larger company with the bucks to support an intensive marketing uplift for *EasyWriter II*.

VisiCorp has introduced *VisiWord*, a product that promises to fare well under the *VisiOn* operating umbrella. Software Publishing Corporation entered the market with thousands of demo disks and a modest, low-priced competitor. Microsoft is poised to unleash its own mouse-driven word processor.

Word Plus-PC has hit its stride and *Volkswriter* is holding its own. *WordPerfect* and *Megawriter* are mustering their own challenges and FriendlyWare is readying its own entry.

None of these developments augurs well for Softword breezing into the market with a first product. Yet *MultiMate* scored an eleventh-place finish in its first full month of release and hit the top ten in August, its second month. Its success seems to say much about who is spending the money in the pc market.

MultiMate is not just another word processor—not that any of the newer entries are. But *MultiMate* took a radically different approach. Rather than looking at the products already introduced and trying to find a niche that they weren't addressing, Softword Systems emulated the functionality and approach of the dedicated Wang word processor. *MultiMate* looks, feels, and runs just like the Wang computer in the word processing center down the hall.

If you're sitting at home reading this, that may not seem like one of the two or three most clever marketing approaches since the invention of papyrus. But those of you cribbing looks at this page while sitting at your desk are more likely to appreciate the wisdom of the approach.

MultiMate is as comfortable to many corporate users as an old shoe. Because it functions like the office Wang word processor, the installation of *MultiMate* on the office pcs means that typing pool help can be shanghaied for crunch word processing efforts without the necessity of explaining that all you need to do to insert a character is hit shift-escape-control-seven.

The emulation has no virtue for the home user, for whom Wang may represent either a brand of Chinese noodle or an obscure Japanese motorcycle.

But the corporate buyer is grabbing up *MultiMate* in gobs. That means that *MultiMate*'s success can be used as one gauge of the buying power of corporate America in the IBM Personal Computer marketplace. And the big companies are obviously having a more significant impact in this market than in any other consumer-oriented microcomputer bourse.

MultiMate's success is not necessarily coming at the expense of competitive word processors. *WordStar* has never been stronger, although how long MicroPro can support the product successfully with bundling tactics remains a question. *PFS:Write* looks to be a big winner on the home front—its ease of use and moderate price apparently being its salient selling features.

EasyWriter II and *Volkswriter* bounced back into the Top Thirty after a month's hiatus, and *WordPerfect* maintained a position on the charts.

The big loser was *Word Plus-PC*. After hitting stride and making a

serious run at *WordStar*, it tailed off seriously in August. Some retailers reported a shortage of product, while others reported a shifting of customer preference.

MultiMate's success among corporate buyers verifies what other entries at the top of the Top Thirty imply—that the pc is basically a business machine. The first five programs—*1-2-3, WordStar, Multiplan, dBase II,* and *VisiCalc*—are all serious business applications with more appeal to corporate users than to home users.

But the presence of *PFS:File* and *Home Accountant Plus* in the next two positions implies equally that there are a substantial number of home users out there.

Entertainment software sales continue to disappoint. With the decline in sales of *Microsoft Flight Simulator,* no "frivolous" software is in the top ten. *FriendlyWare P.C. Arcade* regained the Top Thirty and was the second highest ranked entertainment product. *Microsoft Decathlon* and *Frogger* were the only other two game products to make the list.

IBM-franchised retail stores representing approximately 4.79 percent of all sales of IBM and IBM-related products volunteered to participate in the poll.

Respondents were contacted early in September to ascertain their sales for the month of August.

The only criterion for inclusion on the list was the number of units sold; such other criteria as quality of product, profitability to the computer store, and personal preference of the individual respondents were not considered.

Respondents in September represented every geographical area of the continental United States.

Results of the responses were tabulated using a formula that resulted in the index number to the left of the program name in the Top Thirty listing. The index number is an arbitrary measure of relative strength of the programs listed. Index numbers are correlative only to the month in which they are printed; readers cannot assume that an index rating of 50 in one month represents equivalent sales to an index number of 50 in another month.

Probability of statistical error is plus or minus 4.55 percent, which translates roughly into the theoretical possibility of a change of 4.91 points, plus or minus, in any index number.

The prospect that corporate America is supporting the pc market must be a daunting one for aspiring software suppliers. It takes more money and different expertise to market for that environment. Unless, of course, you have a corporate product like *MultiMate.* ▲

the top thirty

This Month	Last Month	Index	
1.	1.	363.24	**1-2-3,** Mitch Kapor and Jonathan Sachs; Lotus Development
2.	2.	176.55	**WordStar;** MicroPro
3.	15.	98.75	**Multiplan,** Microsoft; IBM
4.	5.	98.08	**dBase II,** Wayne Ratliff; Ashton-Tate
5.	9.	89.96	**VisiCalc,** Software Arts/Dan Bricklin and Robert Frankston; VisiCorp, IBM
6.	7.	73.05	**PFS:File,** John Page and D.D. Roberts; Software Publishing Corporation
7.	9.	68.99	**Home Accountant Plus,** Mike Farmer, Bob Schoenburg, Larry Grodin, and Steve Pollack; Continental Software
8.	6.	64.26	**Asynchronous Communications Support 2.0;** IBM
9.	15.	60.20	**PFS:Write,** Sam Edwards, Brad Crain, and Ed Mitchell; Software Publishing Corporation
10.	11.	56.82	**MultiMate,** Softword Systems
11.	22.	50.73	**Typing Tutor,** Michael Sierchio (Dick Ainsworth and Al Baker); IBM (Microsoft)
12.	4.	48.02	**Microsoft Flight Simulator,** Bruce Artwick; Microsoft
13.	19.	37.88	**PFS:Report,** John Page; Software Publishing Corporation
14.	21.	31.79	**Cdex Training for the IBM PC,** Rohit Patel; Cdex Corporation
15.	—	29.08	**Cdex Training for VisiCalc,** Dr. Stephen C. Brandt; Cdex Corporation
16.	—	27.73	**PFS:Graph,** Bessie Chin and Stephen Hill; Software Publishing Corporation
17.	8.	22.99	**Norton Utilities,** Peter Norton; Peter Norton Inc.
18.	—	22.32	**Basic Compiler,** Microsoft; IBM
19.	—	21.64	**FriendlyWare P.C. Arcade,** Michael D. Yaw, James J. Davis, Alan Vanchura, Jr., R.B. Roberts, and Anthony Chumak; FriendlySoft
	20.	21.64	**The Instructor,** Jo-L Hendrickson; Individual Software
21.	15.	20.96	**Transend II,** Tim Dygert and Bob Kniskern; SSM
22.	25.	20.29	**Macro Assembler,** Microsoft; IBM
23.	14.	18.94	**Smartcom II;** Hayes Microcomputer Products
	—	18.94	**EasyWriter II,** Basic Software Group; Information Unlimited Software
25.	—	15.55	**Volkswriter,** Camilo Wilson; Lifetree
	—	15.55	**PC Tutor,** Lora Meise and Rick Lane; Comprehensive Software Support
27.	12.	14.20	**Crosstalk;** Microstuf
	30.	14.20	**Microsoft Decathlon,** Tim Smith; IBM (Microsoft)
	13.	14.20	**Frogger,** Olaf Lubeck; Sierra On-Line
30.	15.	13.52	**MasterType,** Bruce Zweig; Lightning Software
	22.	13.52	**WordPerfect,** Alan Ashton and Bruce Bastian; Satellite Software International

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